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THE OTTAWA FIELD-NATURALISTS' CLUB

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The CANADIAN FIELD-NATURALIST

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THE OTTAWA FIELD-NATURALISTS' CLUB

FOUNDED IN 1879

The objects of the club are to foster an acquaintance with and a love of nature, to encourage investigation and to publish the results of original research and observations in all branches of natural history. The patrons are Their Excellencies the Governor General and Madame Vanier. The club is a corporate member of the Federation of Ontario Naturalists.

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The Canadian Field-Naturalist

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DAVID C. MADDOX

1877-1960

As AN example of perennial youth in hoary age our esteemed friend, David Maddox, may well be remembered. He was attuned to youth in a remarkable degree. With things geological, mineral and fossil as his themes he could stir unbounded interest in the youngest of his disciples.

Mr. Maddox was a familiar figure in gatherings of members of the Field-Naturalists' Club and was in the forefront of the activities of its jointly sponsored Macoun Field Club. Serving on the Committee for that project, he also was ever available in the Club for questioning by individual members or for more formal talks in the groups. He was a generous donor to the club room, both of books and of geological specimens. He was the first editor, and largely the early architect of its publication, *Ursa Minor, the Little Bear*. Equally enthusiastic was the support he gave for many years to Woodland Boys' Camp, where geology became a vital part of its natural history in the field and in its unique museum. Magnetic sand along the shore and fantastic clay concretions at nearby cliffs were magic in his hands.

David C. Maddox was born at Burford, Oxfordshire, England, Nov. 1, 1877. After graduating with silver medal in chemistry and physics at Westminster College of Pharmacy he worked as a pharmacist in England and in Canada, where he arrived in 1907. During the First World War he started studies in Khaki College, which, continued at Queens University, Kingston, gained him his B.Sc. degree in 1922. Joining the Borings Division of the Geological Survey of Canada, he worked subsequently in both eastern and western Canada, published results in Survey reports, and retired in 1946.

In retirement Mr. Maddox was far from idle. His early pharmacy diploma hung alongside that of a local druggist for whom he relieved on occasion. He was always a tireless reader and traveled rather extensively in recent years. His interest in youth, already noted, brought him into the local Boys' Work Board of the Council of Christian Education. He was active in Kingsway United Church, in choir and session, and a few years ago was honored with a life eldership there. In the world, he was not entirely of it. He retained a reverent and esthetic sensibility that was well expressed in published verse.

In 1956 Mr. Maddox was bereaved of his good helpmeet. He leaves a married daughter and two grandchildren at Mackay, Alberta, and a son, now in the library of Mount Allison University, Sackville, New Brunswick.

HERBERT GROH

Mailing date of this number: 9 March 1961

COWBIRD HOSTS IN SOUTHERN QUEBEC

Lewis McIver Terrill
Ulverton, Quebec

Although much has been published on the parasitic habits of the Brown-headed Cowbird *Molothrus ater ater* very little pertains to Quebec Province. In this account I have attempted to show the degree of parasitism suffered by each of the host victims, giving the number of occupied nests examined, the number and percentage of those parasitized and the extreme dates recorded. Data are mainly from my own records, which, for a few host species, cover a period of more than fifty years. I am indebted to William James Brown and Napier Smith, both of Montreal, for particulars of several unusual victims. Certain records from the annual reports of the Province of Quebec Society for the Protection of Birds (1938-1956) have also been used.

The Cowbird was listed by Wintle as 'common' in the Montreal district during the fifteen years preceding publication of his *Birds of Montreal* in 1896. He recorded twenty-two parasitized nests of twelve species: a flycatcher, two thrushes, a vireo, three warblers and five finches.

The present account (1896-1958) also is based largely on observations made in the Montreal district, but it includes many others from various localities, one of them, the most northerly, from Matane County. Amongst the forty-two host species recorded for Quebec are three flycatchers, four thrushes, three vireos, fourteen warblers and eleven finches. These five families still include the principal victims of the Cowbird, as they did in Wintle's time. Omitting two wholly intolerant birds, Robin and Catbird, and the rarely victimized Red-winged Blackbird, I have records of 390 parasitized nests amongst 4452 occupied nests of other host species examined. From these data it would seem that 8.8 percent, or about one in eleven nests of known host species, is parasitized. I believe the figures give a fair idea of the incidence of Cowbird parasitism in extreme southern Quebec.

Little attempt has been made to show the effect of parasitism either on host or parasite, chiefly because of lack of sufficient data; in some cases eggs or young of the Cowbird were destroyed; some of the earlier nests were collected and many others were not revisited. Most of the host species listed, if they accept the imposition, are usually devoted foster parents, rearing the young parasite successfully although at the expense of some or all host young. I have no record of a foster parent fledging a normal complement of her own young in addition to one or more of the Cowbird.

Mrs. Margaret Nice (1939) found that in Oklahoma each Cowbird reared by Song Sparrows resulted in the loss of one host young. Very similar conclusions were recorded by Norris (1947) with reference to various small passerine hosts near Butler, Pennsylvania; also by Berger (1951) in Washtenaw County, Michigan. Apparently losses are more severe in some areas farther north. In Ontario, Paul Harrington estimates the loss of 100 parasitized nests at Toronto as approximately three and one-third host young for each Cowbird raised to a self-sustained age (Bent, 1958). In Quebec the fledging of even one host young per nest amongst the smaller passerines is notable. More often there are no survivors.

A few species, absent in my list, are probably occasional victims of the Cowbird. Also I have no record for the Field Sparrow *Spizella pusilla*, which is very unevenly distributed in Quebec, being most common along the international boundary in Huntingdon and Missisquoi counties. I did, however, find a parasitized nest of this sparrow in Lanark County, near Merrickville, Ontario, where it is rather common. This held three eggs of the host and one of the Cowbird when found on July 3, 1951.

Phoebes and Song Sparrows are usually the earliest victims, but a nest of the Vesper Sparrow with a fresh egg each of host and parasite on April 26 is the earliest parasitized nest recorded during the entire period. Goldfinches and Song Sparrows are the most commonly victimized birds late in the season, the latest being a nest of the Song Sparrow on August 16 with a week-old Cowbird the sole occupant; and two nests of the Goldfinch on August 4, each with an egg of the Cowbird and five or six of the Goldfinch, all slightly incubated.

ANNOTATED LIST

EASTERN PHOEBE *Sayornis phoebe*. Occupied nests examined, 108; nests parasitized, 28 (26%); extreme dates: April 29, June 25.

My introduction to the parasitic habits of the Cowbird occurred at Montreal in 1896 and the host was the Phoebe, then, as now, one of the more common and submissive victims. Some Cowbirds even appear to show a trend towards specificity on the Phoebe whether the nest site be shed, culvert, rock ledge, or sugar shanty, in the latter case often following the Phoebe deep into the woods. Of course, early in the season, nests of the Phoebe may be the only suitable ones available.

Although generally tolerant, some Phoebes resist Cowbird intrusion either by abandoning the nest and rebuilding or by burying the foreign egg in the lining. The latter method has been observed rather commonly, but only when the Cowbird had laid before the Phoebe. A Phoebe's nest on a window ledge at Philipsburg (Missisquoi County) held two fresh-looking eggs of the Cowbird's egg slightly buried in the lining. partially embedded in the lining. On May 5, 1957, a nest on the same ledge held a single Cowbird's egg slightly buried in the lining. This nest was empty on the 4th. In May 1958, a third nest of the Phoebe on this ledge, empty on the 16th, held a single fresh Cowbird's egg on the 18th. I did not revisit these nests but the Phoebes were present in each case and their obvious concern suggested that they intended to use them. The question arises as to whether or not the Phoebes had finished lining their nests in 1956 and 1957. If not, the partial covering of the Cowbird eggs may have been merely incidental to the completion of the nests. The fact that in 1958 no lining was added suggests that nest-building was completed before the Cowbird laid. Was the Cowbird becoming more expert in synchronizing egg-laying with the nest-building of its prospective host? On the other hand the theory advanced by Herrick to the effect that disturbance of a bird's cycle causes it to go back a stage — if during egg-laying, to nest-building — so aptly applied in explanation of the Yellow Warbler's well-known reactions (Friedmann, 1929), may also explain the Phoebe's behavior.

The Phoebe does sometimes desert her nest and rebuild when a Cowbird's egg has been deposited in advance of her own. For example a nest in a niche on a rock ledge on the precipitous bank of the Black River (Richmond County) held only a Cowbird's egg on June 20, 1954. Within three feet of this on the same ledge a Phoebe was incubating six eggs in another nest.

The following incident will serve to illustrate the Cowbird's disposition on occasion to select the Phoebe as a foster parent in place of some other available hosts. On June 3, 1956, I found three nests of the Phoebe inside a shed at Senneville (Jacques Cartier County). One, an old nest, held several acorns with a fresh egg of the Cowbird on top. A new nest on the same window ledge held five Cowbird's eggs, which were cold and apparently had not been incubated at all. Variation in the eggs suggested that most of the Cowbirds in the vicinity had used the shed as a depository,

but the bird that laid in the acorn-filled nest must surely have been in a great hurry! On the darker side of the shed the Phoebe was incubating three of her own eggs in the third nest.

TRAILL'S FLYCATCHER *Empidonax traillii*. Occupied nests examined, 146; nests parasitized, 9 (6.2%); extreme dates: June 10, July 13.

The rather late nesting of this flycatcher (mostly mid-June through July and into August) probably accounts for the few victims. In June and July, 1957 and 1958, twelve nests at Ulverton (Richmond County) held no Cowbird's eggs. All were in low spiraea (*S. latifolia*) bushes eight inches to three feet from the ground in a bushy area where both Traill's and Cowbird are common. On June 22, 1956, a nest in this area held two Cowbird's eggs and none of the host. This nest was deserted.

LEAST FLYCATCHER *Empidonax minimus*. Occupied nests examined, 15; nests parasitized, 2 (13.3%); extreme dates: June 7, June 24.

Both parasitized nests were found at Ulverton in the same small tamarack and alder bog where a pair of Least Flycatchers had nested annually for the past six years. The nests were built either in upright forks of alders or on tamarack branches. In 1953 the nest held three host eggs and one of the Cowbird on July 7. The 1955 nest held four eggs of the host and one of the Cowbird on June 24. A young Cowbird a few days old was squatting on three eggs of the flycatcher in this nest on July 1 and eventually proved to be the sole survivor. As far as known, nests found here in the other four years were not molested by the Cowbird though there is some doubt about the 1956 nest that held three young flycatchers a few days old when found on July 5. An unbroken, fresh-looking egg of the Cowbird lay on the ground a few feet from the nest. There was no question of human interference and it seems doubtful that this small flycatcher, one of the smallest of Cowbird hosts, had managed to eject the intruder's egg. The Cowbird synchronizes rather closely the time of entering the host nest with necessity for laying, taking only a minute or even less to lay (Hann, 1937). In all probability the Cowbird had marked this nest for her own purpose and Cowbird miscalculation or flycatcher determination to sit tight had prevented her from gaining access to it in time.

HORNED LARK *Eremophila alpestris*. Occupied nests examined, 201; nests parasitized, 3 (1.5%); extreme dates: May 4, July 6.

Evidently a tolerant host but seldom affected, as is the case with other birds nesting well out in open fields. A nest found in corn stubble near Ste. Dorothée (Laval County) on July 6, 1950, held two eggs of the host and three of the Cowbird, all well incubated. The Cowbird's eggs were removed and the host eggs hatched in due course (William James Brown, MS). On August 1, 1952, Carroll Sait saw a Horned Lark by a roadside at Huntingdon (Huntingdon County) feeding a young Cowbird able to fly; this is an extremely late date. A nest found by W. H. Rawlings in the Town of Mount Royal (Hochelaga County) held three eggs of the Lark on April 27, 1952, but, later in the day, only two. On the 29th one egg was balanced on the rim of the nest and on May 4 the nest held a Cowbird's egg and none of the host (P.Q.S.P.B. Annual Report, 1952).

CATBIRD *Dumetella carolinensis*. Occupied nests examined, 163; nests parasitized, 1 (0.6%).

Friedmann (1929) considers the Catbird a most intolerant host. The single parasitized nest found by me was in a hawthorn thicket on Mount Royal, Montreal, and it held only a Cowbird's egg on May 24, 1944. On the 31st the Cowbird's egg had disappeared and the Catbird was incubating four of her own eggs.

BROWN THRASHER *Toxostoma rufum*. Occupied nests examined, 18; nests parasitized, 1 (5.5%).

The parasitized nest was on the ground (the only ground nest recorded) partly concealed beneath protruding branches of a shrubby gray birch on the fringe of a bushy clearing near Hudson (Vaudreuil County). It held four fresh-looking eggs of the Thrasher and one of the Cowbird on May 24, 1949. The nest was not revisited.

ROBIN *Turdus migratorius*. Occupied nests examined, many hundreds; nests parasitized, 1.

A nest found on May 14, 1943, in a hawthorn bush near Montreal West, held three slightly incubated eggs of the Robin and a fresh-looking egg of the Cowbird. The eggs were cold and the nest apparently deserted. About fifteen feet away another nest had a single Robin's egg (Napier Smith, MS). In view of the Robin's intolerance of the Cow-

bird near its nest and its practice of ejecting the parasite's egg (Friedmann, 1929), it seems probable that in this case the nest was deserted before the Cowbird laid. We have no evidence in Quebec that a Robin has ever incubated a Cowbird's egg.

HERMIT THRUSH *Hylocichla guttata.* Occupied nests examined, 120; nests parasitized, 6 (5%); extreme dates: May 24, July 12.

Apparently a submissive host. None of the parasitized nests held the usual complement of four host eggs, generally only two or three with one or two of the Cowbird. An unusual case was a nest at Philipsburg with an egg of the Thrush and three of the Cowbird on May 24, 1952. One of the latter was partly embedded in the lining.

VEERY *Hylocichla fuscescens.* Occupied nests examined, 128; nests parasitized, 17 (13.3%); extreme dates: May 31, July 11.

A very tolerant host. There is evidence that the Cowbird commonly ejects one or more eggs of the Veery, but I know of no evidence that the Veery, only slightly smaller than the Cowbird, ever makes any attempt to eject or bury the Cowbird's egg. A nest found at Ste. Dorothée on June 5, 1949, held the unusual number of four eggs of the parasite and only one of the Veery. At Senneville on June 21, 1952, I watched a Veery feeding a nestling Cowbird about five days old. Beneath the nestling were two eggs of the Cowbird that failed to hatch. There was no sign of eggs or young of the Veery.

EASTERN BLUEBIRD *Sialia sialis.* Occupied nests examined, 54; nests parasitized, 1 (1.9%).

The single parasitized nest was found at Bury (Compton County) on May 11, 1902, and contained three eggs of the host and one of the Cowbird. These were frost-cracked, doubtless the result of severe cold on May 9-10. The nest was in the hollow core of a stump on the margin of a millpond. The Cowbird was scarce in this district during the years 1899-1902 and the Bluebird was the only victim noted (Terrill, 1904). Many nests of the Bluebird at Bury and elsewhere were not examined.

RUBY-CROWNED KINGLET *Regulus calendula.* Occupied nests examined, 23; nests parasitized, 2 (8.7%); extreme dates: June 5, June 28.

This is the smallest victim of the Cowbird recorded in Quebec. I found the nest of one of the victims at Nominingue (Labelle County) on June 25, 1928, when it held ten eggs of the Kinglet and an egg of the Cowbird on top of them, all slightly incubated. The male Kinglet was singing nearby and the female scolded as she left the nest. How the Cowbird managed to drop her much heavier egg onto the host eggs without injuring any of them is a mystery. It seemed strange, too, that none of the more suitable nests found in this wood (one each of Hermit Thrush, Myrtle and Magnolia Warbler, three of Chipping Sparrow and five of White-throated Sparrow) were victimized. An old Kinglet's nest, probably of the previous year, about a hundred feet away, held four stale eggs of the Kinglet almost completely buried in the lining, only the surface of two being visible. It is perhaps idle to speculate on the reason for such behavior, but one wonders whether the Kinglet had been intimidated by the mere presence of a Cowbird and had gone back a stage from egg-laying to nest-building. Both nests were typical purse-shaped structures suspended from twigs near the trunks of slender black spruce saplings, eight and nine feet from the ground in boggy coniferous woods.

Ten is the normal maximum complement of eggs in a clutch of this Kinglet, which suggests that the Cowbird did not practice its usual custom of ejecting a host egg in the course of laying its own. The Cowbird was scarce in the district and several other Ruby-crowned Kinglet's nests were not molested.

The other parasitized nest was found by John Abbott at Senneville on June 16, 1947. It was suspended from a branch of a large spruce tree in front of the Abbott's house, about eighteen feet from the ground, nearly the same distance from the trunk and four or five feet from the tip; the site resembled that of the Golden-crowned Kinglet in this respect. On June 28, when I first examined the nest, it held five addled eggs of the Kinglet and one of the Cowbird. A Kinglet was seen repeatedly in the vicinity attended by a clamoring young Cowbird, apparently the sole survivor. This was the first recorded nesting of the Ruby-crowned Kinglet on Montreal Island. Friedmann (1929) cites only one parasitized nest, which was taken at Lennoxville (Sherbrooke County) on May 15, 1882, by Montague Chamberlain.

CEDAR WAXWING *Bombycilla cedrorum.* Occupied nests examined, 329; nests parasitized, 4 (1.2%); extreme dates: June 30, July 17.

The late nesting of the Waxwing, mostly during July and August, doubtless accounts partly for the small percentage victimized by the Cowbird. The first of these, found at Montreal on July 1, 1896, held an egg of the host and one of the Cowbird. None of the parasitized nests held more than one egg of the Cowbird. Judging by the few records this species appears to be a tolerant host.

YELLOW-THROATED VIREO *Vireo flavifrons*. No nests examined, but I saw fledged young of the Cowbird being fed by this Vireo on the following occasions: July 22, 1921, at St. Lambert (Chambly County), and July 10, 1937, at Senneville.

RED-EYED VIREO *Vireo olivaceus*. Occupied nests examined, 64; nests parasitized, 27 (42.2%); extreme dates: June 5, July 28.

The evidence indicates that this Vireo is victimized more regularly than any other host species commonly imposed upon. This appears to be the case in many sections where the two birds occur commonly. According to Friedmann (1929), "no species suffers more and few as much." Although usually tolerant, when the Cowbird lays first the Vireo frequently deserts the nest.

WARBLING VIREO *Vireo gilvus*. The single nest examined in the Montreal area was not parasitized, nor were several others examined by Napier Smith (MS) at Magog (Stanstead County). However, a Warbling Vireo was observed feeding a young Cowbird at Ulverton on August 19, 1956. The Cowbird was well fledged and followed the Vireo persistently. The fact that nests of this Vireo are built normally at much higher elevations than those of the Red-eyed probably accounts for the disparity in the number parasitized. Cowbirds show a decided preference for hosts nesting on or near the ground.

BLACK AND WHITE WARBLER *Mniotilta varia*. Occupied nests examined, 14; nests parasitized, 4 (28.5%); extreme dates: June 3, June 28.

The few records suggest that this species is a submissive host. None of the nests held more than a single egg of the Cowbird. Two found June 5 and 13, 1927, in dense second growth at Brosseau (Laprairie County), held in addition the normal complement of five host eggs. The eggs were slightly incubated in each case.

NASHVILLE WARBLER *Vermivora ruficapilla*. Occupied nests examined, 83; nests parasitized, 6 (7.2%); extreme dates: May 19, June 14.

It should be noted that a considerable number of the nests examined were found in sphagnum bogs in localities where the Cowbird was rare or absent. All but one of the parasitized nests were found in the Montreal district. One of these, found June 4, 1943, at Ste. Dorothée by W. J. Brown (MS), held two host eggs and two of the Cowbird.

An unusual instance was recorded by the writer at Senneville on June 3, 1939, when a Nashville Warbler was flushed from an exposed nest on the sloping bank of a path in a pine grove, the sitting bird being in plain view from the path. The nest held three very similar eggs of the Cowbird and none of the host. An eggshell of the warbler was found on the ground near the nest, which was empty when revisited a few days later. Apparently a tolerant or at least a submissive host.

YELLOW WARBLER *Dendroica petechia*. Occupied nests examined, 307; nests parasitized, 42 (13.6%); extreme dates: May 25, July 5.

This species is unique amongst warblers in its determined resistance to Cowbird intrusion, either by deserting the nest and rebuilding elsewhere, or by burying the alien eggs, sometimes with one or more of its own, beneath a new, superimposed nest in which the female proceeds to complete the clutch. If further molested by the Cowbird it usually follows the latter course. Twelve of the forty-two parasitized nests recorded by me were deserted; ten others had from two to four stories; and the imposition was apparently accepted in the other twenty.

Acceptance by nearly half of the victims seems a large percentage for this warbler, but it should be noted that normal complements of four or five host eggs were found in eight nests, three host eggs in nine and two in the others. It is known that the female Yellow Warbler often starts to incubate before egg-laying is completed (Bent, 1953), and it seems probable that it normally accepts the parasite's egg only if laid while its own are being incubated. Several observers have described the removal of host eggs by the Cowbird. Mrs. Nice (1939) saw a Cowbird take a Song Sparrow's egg and eat it, shell and all. Hann (1937) saw an Ovenbird's egg removed from the nest and eaten. He thinks this a common habit but does not believe that Cowbird's take eggs for their food value. He and others consider the Cowbird a very useful bird aside from

parasitic habits. The custom of eating host eggs is a probable explanation why missing eggs, presumably ejected by the Cowbird, are infrequently found.

In addition to seeing the forty-two parasitized nests, I have on many occasions watched a Yellow Warbler struggling to satisfy the lusty appetite of a young Cowbird out of the nest.

MAGNOLIA WARBLER *Dendroica magnolia.* Occupied nests examined, 147; nests parasitized, 6 (4%); extreme dates: June 7, June 27.

In four of the six parasitized nests the Warbler had obviously submitted to the imposition. Each of the others held an egg of the Cowbird but none of the host. Both were deserted and in one of them, found at Lanoraie (Berthier County) on June 7, 1942, the egg was partly embedded in the lining.

BLACK-THROATED BLUE WARBLER *Dendroica caerulescens.* Occupied nests examined, 7; nests parasitized, 3 (43%); extreme dates: June 26, July 4.

All three instances of parasitism were noted by the writer in the same rather open, mature maple wood, or sugarbush, at Ulverton. On June 4, 1953, the insistent hunger calls of a well-grown Cowbird in a tree top thirty-five feet from the ground drew attention to a male Black-throated Blue Warbler in the act of feeding it. During the warbler's absences the Cowbird showed marked ability in obtaining its own food. There was no sign of host young, but the absence of the female warbler left some doubt regarding their fate. On June 26, 1954, a female of this warbler was flushed from a nest in a maple shrub. This nest held two fresh-looking eggs of the warbler and two of the Cowbird, the latter apparently the product of different birds, one being much larger than the other. This was removed. I did not revisit this nest until July 19 when it held an addled egg of the Cowbird. Small splashes of lime beneath the nest suggested that the warbler's eggs had hatched and the young fledged. Another nest in a ground-hemlock (*Taxus canadensis*) shrub a few inches from the ground was found on June 26, 1954; it held an almost fully fledged Cowbird covering an addled egg of the Cowbird.

The few records indicate that this warbler is a very submissive host.

MYRTLE WARBLER *Dendroica coronata.* Occupied nests examined, 33; nests parasitized, 2 (6%); extreme dates: June 22, June 28.

A nest, found June 28, 1947, at Leggatt's Point, Metis (Matane County) held a well-grown Cowbird and a host nestling (Napier Smith, MS). This is the most northerly instance of Cowbird parasitism in Quebec Province that I know of. The other nest was found by me on June 22, 1955, in a spruce bog near Ulverton. This was well hidden in a shrubby black spruce about four feet from the ground. It held an egg of the Cowbird and two of the warbler, all apparently somewhat incubated. The nest was not revisited.

BLACK-THROATED GREEN WARBLER *Dendroica virens.* Occupied nests examined, 16; nests parasitized, 2 (12.5%); extreme dates: June 11, June 26.

A nest found at Ste. Rose (Laval County) by W. J. Brown (MS) held three eggs of the warbler and one of the Cowbird on June 11, 1938. Another, found by the writer at Ulverton on June 26, 1955, held two fresh-looking eggs of the Cowbird, apparently laid by different birds. There was no evidence of host eggs either in the nest or on the ground, although these had probably been removed by the Cowbird. The female warbler was still incubating the two Cowbird's eggs on July 3 and she returned to the nest as soon as I had climbed down the tree. The nest was fifteen feet from the ground on a hemlock branch in mixed woods, several hundred feet from the nearest clearing, which location provides additional evidence that the Cowbird is continually extending the search for suitable nests deeper into wooded lands.

CHESTNUT-SIDED WARBLER *Dendroica pensylvanica.* Occupied nests examined, 55; nests parasitized, 16 (29%); extreme dates: June 1, July 29.

A rather common victim but not always submissive. Six nests in which the Cowbird had laid before the owner were deserted. Another, found on June 5, 1950, at Ste. Dorothée, held a fresh egg of the warbler and beneath it, almost buried in the lining, an egg of the Cowbird. In a nest found on July 29, 1950, in the Morgan Woods at Senneville a young Cowbird crowded a warbler chick against the nest wall. Both were nearly fledged. The nest was not revisited but it seemed that the warbler would have survived. It was very active and used its wings effectively to flutter out of the nest.

BAY-BREASTED WARBLER *Dendroica castanea*. Occupied nests examined, 15; nests parasitized, 2 (13.3%); extreme dates: June 18, July 7.

Both parasitized nests were recorded by Napier Smith (MS) in the same spruce wood at Kamouraska (Kamouraska County). One of these, under construction when found on July 2, 1950, held two eggs of the warbler and one of the Cowbird on the 7th. The Cowbird's egg was removed and there were two more eggs of the warbler by the 10th. The second nest was found on June 18, 1952, about sixty feet from the first, with two eggs of the Cowbird and none of the warbler. The bird was not seen at this nest, which proved to be deserted, but a male Bay-breasted Warbler was heard singing in the vicinity. Apparently this warbler is an uncommon victim as none of the ten or more nests examined in the Montreal district was affected. Doubtless the nature of its nesting habitat in dense coniferous woods accounts for this.

OVENBIRD *Seiurus aurocapillus*. Occupied nests examined, 61; nests parasitized, 6 (9.8%); extreme dates: May 29, June 13.

A very tolerant host, but apparently less commonly victimized in Quebec than in many districts in the United States. In no case was there evidence that any host eggs had been ejected. Five nests held normal complements of four to five eggs of the Ovenbird and one to three of the Cowbird. The sixth nest with three stale eggs of the Cowbird was found accidentally and was obviously deserted.

NORTHERN WATERTHRUSH *Seiurus noveboracensis*. Occupied nests examined, 18; nests parasitized, 3 (16.6%); extreme dates: May 22, June 11.

The well-hidden nests of this species, usually in wet habitats where the Cowbird is scarce or absent, doubtless account for the few victims. Three nests found in Laval County by W. J. Brown (MS) are the only cases recorded: June 11, 1938, with three eggs of the warbler and one of the Cowbird; May 22, 1941, with two eggs of the warbler and two of the Cowbird (a punctured egg of the warbler lay on the ground a few feet from this nest); and, June 1, 1947, with four eggs of the warbler and one of the Cowbird.

MOURNING WARBLER *Oporornis philadelphia*. Occupied nests examined, 25; nests parasitized, 8 (32%); extreme dates: June 3, July 9.

I have twice found parasitized nests: June 27, 1907, at Caughnawaga (Laprairie County) with two small young of the warbler and one of the Cowbird; and June 12, 1949, at Senneville with a Cowbird's egg and none of the warbler. This nest was deserted.

Apparently the Mourning Warbler is a rather common host near Ste. Dorothée where W. J. Brown (MS) found five nests with one to two eggs of the Cowbird and two to three of the host. In the same locality he also found a nest with two eggs of the Cowbird and none of the warbler. This nest was deserted.

YELLOWTHROAT *Geothlypis trichas*. Occupied nests examined, 113; nests parasitized, 8 (7%); extreme dates: May 31, July 20.

Compared with some other districts the above percentage appears very low, especially as the Cowbird is commonly found in many of the Yellowthroat's nesting haunts. In the only instances (two) where the Cowbird was known to lay first, the nests were deserted. The latest parasitized nest was found July 20, 1939, at Chambly (Chambly County) with one young each of the Warbler and Cowbird. On August 16, 1934, a possible later date, a fledged Cowbird out of the nest was being fed by a female Yellowthroat, Brown, (MS).

REDSTART *Setophaga ruticilla*. Occupied nests examined, 145; nests parasitized, 23 (15.8%); extreme dates: June 2, June 25.

This commonly victimized warbler seldom tolerates the intrusion when the Cowbird lays first. Nine such nests were known to be deserted. In another the Cowbird's egg was accepted and the warbler was later observed incubating it with two of her own eggs.

EASTERN MEADOWLARK *Sturnella magna*. Occupied nests examined, 52; nests parasitized, 1 (2%).

Aside from the Meadowlark's 'open-field' type of nesting habitat, the disparity in size between its egg and that of the Cowbird would seem to render it an undesirable host. The single instance of parasitism was recorded in Laval County by W. J. Brown (MS). When first found on May 22, 1943, the nest held only an egg of the Meadowlark. On the next visit (May 27) the Meadowlark was incubating four of her own eggs and one of the Cowbird.

REDWINGED BLACKBIRD *Agelaius phoeniceus*. Occupied nests examined, many hundreds; nests parasitized, 2 (less than 0.2%); extreme dates: May 23, May 25.

The estimated percentage of parasitized nests of the Redwing is probably too high as many nests examined were not recorded. The female is a model parent and was apparently equally attentive to the eggs and young of the parasite in the two instances noted. I found the first of these nests on May 23, 1953, in a small bed of cattails in a ditch at Hudson, a drier and more restricted habitat than usual. It held four fresh-looking eggs of the host and one of the Cowbird. The other nest, found on May 25, 1957, in Stoneycroft Marsh near Senneville, was also in cattails but in a normal habitat where the water was about a foot deep. The sole occupant was an almost fledged Cowbird. There was no evidence of eggs or young of the Redwing.

At Ithaca, New York, where both Cowbird and Redwing are abundant, according to Friedmann (1929) no parasitized nests of the Redwing have been found. He attributes this to the wet habitat of the Redwing.

ROSE-BREASTED GROSBEAK *Pheucticus ludovicianus*. Occupied nests examined, 42; nests parasitized, 3 (7.1%); extreme dates: May 27, June 4.

In all three instances the female Grosbeak was incubating four of her own eggs and one of the Cowbird. Apparently none of the Grosbeak's eggs had been ejected as four is almost invariably the complement.

INDIGO BUNTING *Passerina cyanea*. Occupied nests examined, 30; nests parasitized, 6 (20%); extreme dates: June 7, July 2.

Evidently this species is frequently intolerant of Cowbird intrusion as two of the six nests with one to two eggs of the Cowbird, but none of the host, were deserted, as well as a third with two eggs of the Cowbird and one of the host. A female in two other nests was incubating the normal complement of four host eggs and one of the Cowbird. It would seem as if the Indigo Bunting resents the intrusion if it occurs before she starts to incubate.

PURPLE FINCH *Carpodacus purpureus*. Occupied nests examined, 16; nests parasitized, 1 (6.2%).

The single instance was a nest found on June 26, 1949, in a spruce sapling in a garden at Kamouraska (Napier Smith, MS). The nest held three fresh eggs of the finch and one of the Cowbird.

AMERICAN GOLDFINCH *Spinus tristis*. Occupied nests examined, 318; nests parasitized, 7 (2.2%); extreme dates: July 22, August 4.

All parasitized nests were found near Montreal in Hochelaga, Jacques Cartier and Chambly counties, where the Goldfinch and Cowbird are usually abundant. Although the bushy nesting haunts of the Goldfinch are commonly frequented by the Cowbird, the late nesting of the Goldfinch (chiefly July and August compared with May and June for the Cowbird) doubtless accounts for the few victims.

A nest at LaSalle (Hochelaga County) on July 26, 1910, with four eggs of the Goldfinch and one of the Cowbird was the first parasitized nest of this species found by me, although Wintle (1896) lists two prior records, one of which was of a nest with five Goldfinch eggs and one Cowbird egg on July 25 (1886). Five other nests (1912-1929) had two features in common. All held normal complements of host eggs (five or six) and but one of the parasite. This suggests tolerance on the part of the Goldfinch despite the striking difference in the eggs; also that the Cowbird does not usually eject any host eggs. However, the latter comment does not apply in the case of the seventh nest, found at Senneville on July 22, 1950, with one egg of the Goldfinch and four of the Cowbird, all somewhat incubated. The female Goldfinch was incubating closely, tolerant as usual, although in all probability most of her own eggs had been removed by the parasite. Three of the Cowbird's eggs, and possibly the fourth, were very much alike and doubtless laid by the same bird. At least one egg of the Cowbird and the host egg failed to hatch.

Presumably the Cowbird does not react in the usual way of a nonparasitic bird and lay a second clutch of eggs if the first is lost. Some, however, may produce more than a single clutch in a season. Suitable host nests available late in the season are scarce, often limited in a Cowbird's territory (in Quebec) to Goldfinch, Waxwing or Song Sparrow. This seasonal scarcity is a possible explanation, I think the probable one, for so many similar Cowbird eggs in a nest of the Goldfinch. The Cowbird usually consigns her eggs singly to the care of different hosts rather than trust all to the care of one.

The sole suggestion of Goldfinch intolerance was noted late this fall (1958) in a nest in which, obviously, young had been raised. Although this nest appeared to be of normal proportions, examination revealed an egg of the Cowbird completely hidden beneath the lining.

SAVANNAH SPARROW *Passerculus sandwichensis*. Occupied nests examined, 140; nests parasitized, 5 (3.6%); extreme dates: May 21, June 4.

This open-field nester is comparatively seldom affected by the Cowbird. In nests examined between 1897 and 1950, four contained 1-2 eggs of the Cowbird and 2-4 of the host; the Sparrow was incubating and evidently tolerant. A fifth instance, observed by John Hollyer at Kamouraska, was of a fledged Cowbird being fed by a Savannah Sparrow during the second week of August near a nest found in July on the grassy foreshore of the St. Lawrence.

VESPER SPARROW *Pooecetes gramineus*. Occupied nests examined, 74; nests parasitized, 3 (4%); extreme dates: April 26, June 9.

This habitué of the open grasslands is seemingly as tolerant as the Savannah Sparrow. A nest found in Laval County, empty on April 20 (1924), held an egg each of host and parasite on April 26 (Brown, MS). This is the earliest parasitized nest of any species of which I have record. Another nest, found at St. Lambert on June 9, 1947, held small nestlings, one each of the Sparrow and Cowbird.

A nest found at Merrickville, Ontario, on July 4, 1954, with an almost fledged Cowbird and two addled eggs of the Sparrow provides an example of a common effect of Cowbird parasitism on the smaller passerine hosts.

SLATE-COLORED JUNCO *Junco hyemalis*. Occupied nests examined, 75; nests parasitized, 1 (1.3%).

It may be because the Junco is a very close sitter and not readily flushed from its well-concealed nest that so few victims are recorded. The single instance noted by me was a nest in a rock garden at Cacouna, Rivière du Loup County. This held three eggs of the Junco and two of the Cowbird on July 7, 1952. Friedmann (1929) lists two other instances from Quebec Province.

CHIPPING SPARROW *Spizella passerina*. Occupied nests examined, 138; nests parasitized, 16 (11.6%); extreme dates: May 20, July 24.

Although July 24 is shown as the latest date of actual nest parasitism, I have seen a fledged Cowbird being fed out of the nest by a Chipping Sparrow as late as August 7.

The Chipping Sparrow commonly deserts its nest when the Cowbird lays first. In one case (June 9, 1950) the Cowbird's egg was buried in the lining although the nest was finally deserted. Amongst conifers the Chippy's nest is better concealed by closely overhanging branches and found by the Cowbird less often than in deciduous growth. In bushy pastures, however, both Chippy and Song Sparrow take advantage of close-cropped hawthorn bushes where the bristling mass of thorny twigs presents a definite obstacle to the nest-hunting Cowbird.

WHITE-THROATED SPARROW *Zonotrichia albicollis*. Occupied nests examined, 507; nests parasitized, 20 (4%); extreme dates: May 24, July 10.

A rather common victim about Montreal and, latterly, in the Eastern Townships. I found Cowbirds very scarce at Bury in the years 1899-1902 and Mousley (1916) also reported them as scarce at Hatley (Stanstead County) in the years 1911-1915. Doubtless the percentage of parasitized nests would be lower if only these two portions of Quebec were considered. The Whitethroat is a most submissive host. I have yet to observe an instance of nest desertion due to the Cowbird. Even when the Cowbird lays first the Whitethroat placidly accepts the intrusion, or so it seems.

Sixteen nests held a single egg or nestling of the parasite, and three others two, together with one to four of the host. Another held three eggs of the Cowbird and four (the normal complement) of the Whitethroat. This was found on May 30, 1943, in the Morgan Woods at Senneville. Farther within the wood, which bordered an open field, another nest of the Whitethroat was not affected by the parasite.

A nest in a bushy pasture at Ulverton would doubtless, if undisturbed, have produced nothing but Cowbirds. When found on June 13, 1958, it held two lusty Cowbirds, and a tiny nestling and two addled eggs of the Whitethroat, evidence of Whitethroat success as a foster parent!

Late dates for parasitized nests are: July 9, 1935, at St. Lambert, and July 10, 1921, at Rawdon (Montcalm County). Each of these held three host eggs and one of the Cowbird. Whitethroats usually have more than one brood and three is often the complement in late nestings.

SWAMP SPARROW *Melospiza georgiana*. Occupied nests examined, 322; nests parasitized, 34 (10.6%); extreme dates: May 14, July 1.

Commonly victimized in the Montreal district where twenty-four parasitized nests were found by the writer in Laprairie and Chambly counties on the south shore of the St. Lawrence. Here the favored nesting sites are in isolated clumps of sedges on the margins of willow-fringed cattail marshes, and the Cowbird usually selects a site where the water is only a few inches deep. There are also records from somewhat similar habitats in the following counties: Laval (Brown, MS), Hochelaga, Jacques Cartier, Two Mountains, Vaudreuil and Richmond.

The status of the Swamp Sparrow as a host of the Cowbird contrasts with conditions in some other sections, notably Ithaca, New York, where no parasitized nests of this species were recorded although it and the Cowbird are common there (Friedmann, 1929).

The Swamp Sparrow appears to be a very tolerant host. In no case was it observed to make any attempt to dispose of the foreign egg, either by ejection, burial, or nest desertion. A single egg of the parasite was found in twenty-nine nests and two in the other five. Nineteen also held the usual complement of four or five host eggs.

SONG SPARROW *Melospiza melodia.* Occupied nests examined, 486; nests parasitized, 62 (12.7%); extreme dates: April 29, August 16.

The abundance, lengthy nesting season and apparent tolerance of the Song Sparrow all tend to make it an ideal foster parent for the young Cowbird. Few birds submit as readily to the imposition. Two eggs of the parasite are commonly found in nests of this Sparrow, less commonly, three, and occasionally as many as four, yet they are incubated and the young reared, although at the expense of some or all host young. I have no record of nest desertion because of Cowbird parasitism, nor of any attempt to bury the alien eggs.

The fact that eggs of the Song Sparrow are seldom strikingly unlike those of the Cowbird might seem to have a bearing on its tolerance, but Friedmann (1929) has shown by experiment that eggs of the Robin and Chipping Sparrow, wholly unlike the Song Sparrow in color and size are readily accepted by the Song Sparrow. Nevertheless the attitude of this sparrow towards an adult Cowbird intruding on its territory is definitely hostile. On June 14-16, 1957, I frequently watched a Song Sparrow feeding a young Cowbird. Although fledged, the Cowbird progressed by hopping instead of the walking gait usual with older Cowbirds. The Song Sparrow was very solicitous, promptly hurrying up to feed it in response to insistent hunger calls. Several times when an adult female Cowbird approached the nesting hedge too closely the Song Sparrow would lower its head, rush at the intruder and drive it off.

The earliest parasitized nest, found near Montreal on April 29, 1947, by Bernard Gollop, held four host eggs and one of the Cowbird. The latest, found by the writer at St. Lambert on August 16, 1931, held only a week-old Cowbird. When handled, instead of crouching low in the nest in the normal attitude of passerine nestlings of this age, it opened its bill and begged for food. A fledged Cowbird following an agitated Song Sparrow at Senneville on August 27, 1950, possibly represents a later date.

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NOTES ON THE MEMBRACIDAE (HOMOPTERA) OF PRINCE EDWARD COUNTY, ONTARIO

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The observations in these notes have been made during a number of years of collecting this interesting group. The nomenclature and arrangement follow E. P. Van Duzee's *Catalogue of the Hemiptera* (1917), except for the Telamonini, which follows E. D. Ball's *Revision of the Telamonini of North America* (1932). Thanks are due S. G. Walley and C. D. Miller of Science Service, Ottawa, for identifying the species of ants.

Ceresa diceros (Say) Plentiful from latter part of June to end of August. Few males seen in September; females numerous to middle of October on elm, bass, willow, dogwood and elder. Nymphs have been fed to maturity on wild raspberry.

Ceresa albescens VanD. Nymphs numerous on ironwood *Ostrya virginiana* and blue beech *Carpinus caroliniana* during July and August. Earliest adult July 20; adults plentiful on same hosts during August and September; females numerous on October 8.

Ceresa bubalus (Fab.) Nymphs found on a wide range of hosts, among which are raspberry, elm, goldenrod and willow. Adults about the second week of July, most plentiful in August. Females numerous on ironwood, bass, dogwood and sweet clover. Scars made by ovipositing are conspicuous on low branches of elm and apple.

Ceresa taurina Fitch The most abundant of the genus, it can be beaten from almost any vegetation during July and August. Nymphs found during June and to early August on apple, Canada thistle, elm, raspberry, goldenrod and ironwood. Large numbers were seen on a mass of nightshade. Transferred to apple under cover, they fed freely to maturity. Mating occurs during August. Earliest adult seen July 2; one male only in September; females plentiful to October 8, 11 were taken from a small hickory on September 20. While ovipositing in bass, they become an easy prey to nymphs of the Pentomid *Podisus maculiventris* Say.

Ceresa constans (Walk.) Resembles *palmeri*; humerals more recurved and pointed. Two females taken August 21.

Ceresa palmeri VanD. Taken during August on hickory and sugar maple. Females, which are much more plentiful than males, found to early October.

Ceresa borealis Fairm. A male, July 6, the first noted. Both sexes plentiful during August, males scarce; females numerous in September on ironwood, hickory, thorn, bluebeech and raspberry. Mating to September 11.

Ceresa basalis Walk. Numerous locally from middle of July to September. Females taken on hazel, wild rose, raspberry and willow.

Stictocephala inermis (Fab.) Nymphs numerous on sweet clover end of June and during July. Earliest adult July 3. Females taken on suckers of apple, on sweet clover, elm, thorn and white oak. These disappear about the middle of September, but a female was found clinging to the glass inside a store window on December 10; possibly it had been brought in with imported vegetables.

Acutalis tartarea (Say) Nymphs and adults numerous during July on goldenrods, the only hosts, usually on the outskirts of damp or marshy localities. Males disappear end of August, two only having been seen in September. Seen mating early August. Females found to end of September, a final one October 22.

Thelia bimaculata (Fab.) The only host of this species is black locust *Robinia pseudo-acacia*. Nymphs found on the main branches, one species of ant *Formica fusca* L. seen attending. Adults numerous from middle of July to middle of October. After severe frost in October females were numerous, still ovipositing in branches and trunks of the host.

Thelia uhleri Stal. The only host is wild plum, on which nymphs are found in June and adults from July to September, the last seen being two females on September 22. A few adults have been found on oak and ironwood, but always in the vicinity of plum, so these can only be regarded as transients.

Glossonotus nimbatulus Ball. Though not taken in this county, has been found a few miles north in the adjoining county, Hastings, on White oak in July.

Glossonotus crataegi (Fitch) Taken only on thorns, *Crataegus* spp. Nymphs in June, earliest adults July 1, females numerous to October.

Glossonotus univittatus Harr. Nymphs and adults found during July on burr oak, which is the main host. Females have also been taken on red and white oaks. Males are less plentiful than females and disappear in early August. Females fairly numerous to end of that month.

Heliria cristata (Fairm.) Collected from hazel during August in Hastings County.

Heliria gibberata Ball. Not taken in Prince Edward County, but one female was collected from white oak in Hastings County during August.

Heliria scalaris (Fairm.) Adults taken rarely on hickory from July to early September.

Palonica pyramidata (Uhl.) Fairly numerous on willows, *Salix* spp. from end of June to last of September, latest October 12. The typical form is the most plentiful. Varieties *declivata* VanD. and *amplicata* Ball, and a single specimen placed as *nasuta* Ball, are also to be found on the same host. One specimen taken has the crest projecting forward and a decided step on the posterior slope.

Telemona maculata VanD. Two females taken on September 27 are the only specimens. It is easily identified by the large humerals.

Telemona ampelopsidis Harr. Nymphs found from second week of May to middle of June on virginia creeper. Earliest adult June 29. Males and females plentiful on host to end of August, females only in September. Most of the females typical in color, but many of the males black. There is considerable variation of the crest in both sexes, many having a step as in *concava* Fitch. Ants do not associate with this species, but a worker of *Formica fusca* L. was seen carrying off a second instar nymph.

Telemona tristis Fitch The two hosts of this species are ironwood and blue beech. Nymphs the second week in May. The typical adult form scarce before August, few having been seen in July. The variety *coryli* Fitch plentiful during July and scarce in September. Females of *tristis* numerous during this month; no males found amongst the large number examined. Typical females have been seen mating with males of *coryli* in July and August.

Telemona unicolor Fitch Nymphs found on hickory during July and August, first and second instars on the previous year's growth, the later stages on the older growth closely resembling the bark. First adult June 22, last, a female September 19. A few stragglers have been taken on oak, but hickory seems to be the only host.

Telemona monticola (Fabr.) Chiefly found on burr oak on which it has been seen with the ovipositer deeply inserted. Nymphs have also been taken on red and white oaks from middle of May to early August, the first instars feeding at base of the new growth. Adults numerous from middle of June to end of August; the latest, a female, September 22. Ants are attracted to the first and second instars of this and some other species of *Telemona* but not to the later stages. Ants found associating with this species are workers of *Crematogaster* (*Acrocoelia*) *lineolata* (Say) and *Formica fusca* L.

Telemona tilioe Ball. The most plentiful of the genus found here. Nymphs found on bass (*Tilia glabra*) from early May to late September, adults from May till killing frosts come, the females sometimes in a continuous row ovipositing in the smaller branches, the scars made being very conspicuous. Workers of the ant *Formica fusca* L. are very numerous, this species freely attending the nymphs.

Telemona westcotti Godg. Nymphs of this species numerous from middle of May to August in crotches of white and burr oaks, first and second instars usually attended by ants. Adults taken from July 19 to September 1, males; September 29, females. On a small white oak at the side of a road numbers of nymphs and adults were seen covered with dust from passing vehicles, so much so that the structure could not be discerned, but this did not seem to inconvenience them in any way. Workers of *Formica fusca* L. are found associating with nymphs.

Telemona reclivata Fitch One taken on August 2, the only record. The long crest distinguishes this from *tiliae*, which it resembles.

Carynota mera (Say) The only host appears to be hickory on which nymphs are found during June and July. First and second instars gather at base of new leaves and crotches of small branches, workers of *Formica fusca* L. attending; third instar usually single in crotches of smaller limbs.

Adults plentiful in July and August, the males being less numerous than females, which continue to middle of October. One female taken on red oak.

Carynota marmorata (Say) Numerous on alder *Alnus incana*, the only host, during July. Nymphs of this species have not been seen. Final adult September 1.

Smilia camelus (Fabr.) Early in appearance, most numerous end of June; latest, a female, August 4. Only taken from red oak.

Cyrtolobus fenestratus Fitch Two females only have been found, on black oak. It is likely that later collecting on this host would find this species more numerous than the record denotes.

Cyrtolobus vau (Say) Nymphs conspicuous in crotches at base of the new growth during June, often feeding head downwards. Earliest adult, June 11. Mating during June and July, the males disappearing at end of month. Females are numerous to end of August, less so in September. Hosts are white, burr, post and red oaks.

Cyrtolobus maculifrontis (Emns.) Another common species, often found in company with *vau*. Adults from June 12 into September, males disappearing at end of July, females continuing into September. Hosts are white, burr, and post oaks.

Cyrtolobus intermedium (Emns.) Females only have been taken sparingly on red oak from June 30 to September.

Cyrtolobus (*Atymna*) *querci* Fitch Males taken from middle of June to July 15, latest females September 1. Seen mating in June and ovipositing in burr oak during August. Females have also been beaten from white oak.

Cyrtolobus (*Xantholobus*) *muticus* (Fab.) Scarce. Males taken latter part of June. Female, to July 29, on white oak.

Ophiderma salamandra Fairm. Rare. Females only taken during June and July on oak.

Ophiderma pubescens Emns. Males only have been beaten from white and red oaks during July and August.

Ophiderma flavicephala Godg. One male only, taken June 24.

Ophiderma flava Godg. Females beaten during June and July from white, red and black oaks.

Entylia bactriana Germ. This and *E. carinata* (Forst.) can almost be treated as one. Hibernating in the adult stage, taken by sifting in early spring and late fall under leaves, emerging from winter quarters when conditions are favorable, females much more plentiful than males. Mating in early June. The males disappear, females continuing to end of that month. Nymphs found on Scotch and Canada thistles during August and September. Adults develop and remain on host until they are forced into winter quarters. Adults have also been swept from goldenrod and asters. A number of ants associate with these species; these were observed even on the beating tray, feeding on the liquid from the anal aperture. Species found associating: *Campanatus pennsylvanica* (DeGeer), *Formica fusca* L., *Formica sanguinea subnuda* Emery, *Crematogaster lineolata* (Say), *Tapinoma sessile* (Say).

Publilia concava (Say) Hibernates under leaves. Adults emerge from winter quarters during May, females more plentiful than males, mating on emergence to early July. The chief host is goldenrod, on which the eggs masses can be detected by the female remaining with the eggs and nymphs until they reach maturity; it is then difficult to distinguish her from the newly matured adults. On June 21, of a number of egg masses found on goldenrod, those counted averaged 45 eggs. One was kept under observation. The female had evidently just finished depositing 43 eggs in and along each side of the midrib of the leaf. Six days later three additional eggs had been added. The nymphs were irregular in appearance, fourteen emerging from the egg stage on the fourteenth day. Seven days later they totaled 30 and on the twenty-eighth day 43 were counted. The first adults, four in number, developed 62 days after the eggs were first seen and they were followed at intervals by others. Four nymphs and 17 adults were still on the food plant on August 31, the others having left. Other hosts noted: Canada thistle, elecampane, and joe-pye weed. Workers of the following species of ants have been found associating with this species: *Formica fusca* L., *Camponotus noveboracensis* (Fitch), *Crematogaster* (*Acrocoelia*) *lineolata* (Say), *Lasium alienus americanus* Em., *Myrmica brevispinosa discontinua* Web.

Campylenchia latipes (Say) Nymphs found on goldenrod during June, July, and August. First adult June 26, very plentiful in September. Seen mating in July. The latest, a female, November 1. Other hosts are sweet clover, alfalfa and elecampane. Two species

of ants have been found attending *Formica fusca* L. with adults, *Cremotogaster lineolata* (Say), with nymphs.

Enchenopa binotata (Say) The color of nymphs of this species varies with the hosts on which it feeds. Nymphs are found on butternut, hickory, bittersweet and nannyberry (*Viburnum lentago* L.). Numbers of females were observed making elongate slits in the terminal buds and tips of the lower branches of butternut during September. Twelve slits were seen in one bud, the average being five or six to a bud. Some of the egg slits were open; others were at least partially covered with a grayish matter. The black-and-white color of the nymphs on butternut make them quite conspicuous. On hickory the nymphs are of a roseate hue, not as conspicuous as those on butternut. The eggs are inserted at the extreme end of the smaller branches. On bittersweet the egg slits are made on the smaller vines, the nymphs grayish in color. But it is on nannyberry (*Viburnum lentago* L.) that females and the early stages are most numerous. Large numbers of females, often so crowded as to almost touch each other, can be seen ovipositing, sometimes head downwards, on the smaller branches. The egg slits, occasionally two under one mass, are covered with a white glutinous mass. The glutin probably provides protection from weather and predators. In the spring the glutin is somewhat weatherworn and it can be seen to have been deposited in a rib or herringbone pattern. Many of the slits are then open and the eggs exposed. Eggs in each slit vary from two to six. First-instar nymphs are found about the middle of May. On emerging they make their way to the cymes and feed on the stems of the florets. As the blossoms fall, the nymphs descend to the crotches of the latest growth. It appears as if some develop to the later instars on this host, a few having been found amongst the berries, but they mostly leave after the second instar and are then found on thistles, goldenrod, and other ground vegetation, to the end of July. First adults are found in early July, males disappearing middle of August, females end of September, a few continuing to early October. No males have been taken on the nannyberry. Ants attracted by the so-called honeydew, but not interfering with the instars are *Formica fusca* L. on the nannyberry, and *Lasius alienus americanus* Em. on thistle.

Microcentrus caryae (Fitch) Late in developing, nymphs and adults are numerous on hickory during August. Few males survive over the end of that month, females to middle of October. One nymph was found on ironwood and a fourth instar nymph has been seen being preyed on by a nymph of *Podisus* sp.

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INSECTS COLLECTED FROM WOODCHUCK BURROWS IN THE VICINITY OF LONDON, ONTARIO

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During the summer of 1957 I collected adult insects from thirty burrows of the woodchuck, *Marmota monax* (L.), in the vicinity of London, Ontario. I gathered by hand the soil and debris from the bottom of the outer one yard of the burrow's length and from the mound of dirt at the entrance of the burrow, and extracted the insects from it with an aspirator or forceps and put them in a poison jar. The insects were then taken to the laboratory and pinned, preserved in fluid or mounted on microscope slides. The collections were made while the writer held a summer research associateship of the National Research Council.

The insects were distributed for identification to the following taxonomists who, unless otherwise noted, are members of the Entomology Research Institute of the Canada Department of Agriculture: E. C. Becker (Elateridae), W. J. Brown (Staphylinidae, Curculionidae, Carabidae, Silphidae), J. G. Chillcott (Anthomyiidae, Borboridae), G. P. Holland (Siphonaptera), H. F. Howden (Scarabaeidae, Nitidulidae, Histeridae), W. R. M. Mason (Braconidae), H. B. Mills, Illinois Natural History Survey, Urbana, Illinois (Collembola), O. Peck (Ceraphronidae), M. R. Smith, Entomology Research Division, U. S. Department of Agriculture (Formicidae), J. R. Vockeroth (Phoridae, Sciaridae). All specimens are deposited in the collections of the Department of Zoology, University of Western Ontario, except for some retained in the Canadian National Collection as noted (CNC) in the following account.

The burrows from which the insects were collected were located in London Township and Westminster Township to the north and south of the city of London (Figure 1), as follows: Burrows 1-8, June 12, in fields just south of the North Branch of the Thames River; burrows 9-14, June 22, in fields and on wooded slopes along the North Branch of the Thames River; burrows 15-21, June 26, in fields and hedgerows along the South Branch of the Thames River; burrows 22, 23, August 5, on wooded slopes along Medway Creek; burrows 24-30, August 23, on wooded slopes and in gulleys adjacent to Walker Ponds. The insects collected from the thirty burrows (numbered 1-30) were as follows:

1. Hymenoptera: Formicidae: *Formica fusca* L. - 1
   Tapinoma sessile (Say) - 1
2. Coleoptera: Staphylinidae: Aleocharinae - 1
   Histeridae: *Hister* (?*memnonius* Say) - 4
   Curculionidae: *Barypeithes pellucidus* (Boh.) - 1
3. Coleoptera: Staphylinidae: Aleocharinae - 8
   Histeridae: *Hister* (? *memnonius* Say) - 1
   Saprinus (? *posthumus* Mars.) - 1 (in CNC)
   Diptera: Borboridae: *Leptocera* (*Scotophilella*) sp. - 1♂ (in CNC)
   Hymenoptera: Formicidae: *Lasius alienus* (Foerst.) - 8
4. Coleoptera: Staphylinidae: Aleocharinae - 4
   Hymenoptera: Formicidae: *Lasius alienus* (Foerst.) - 1

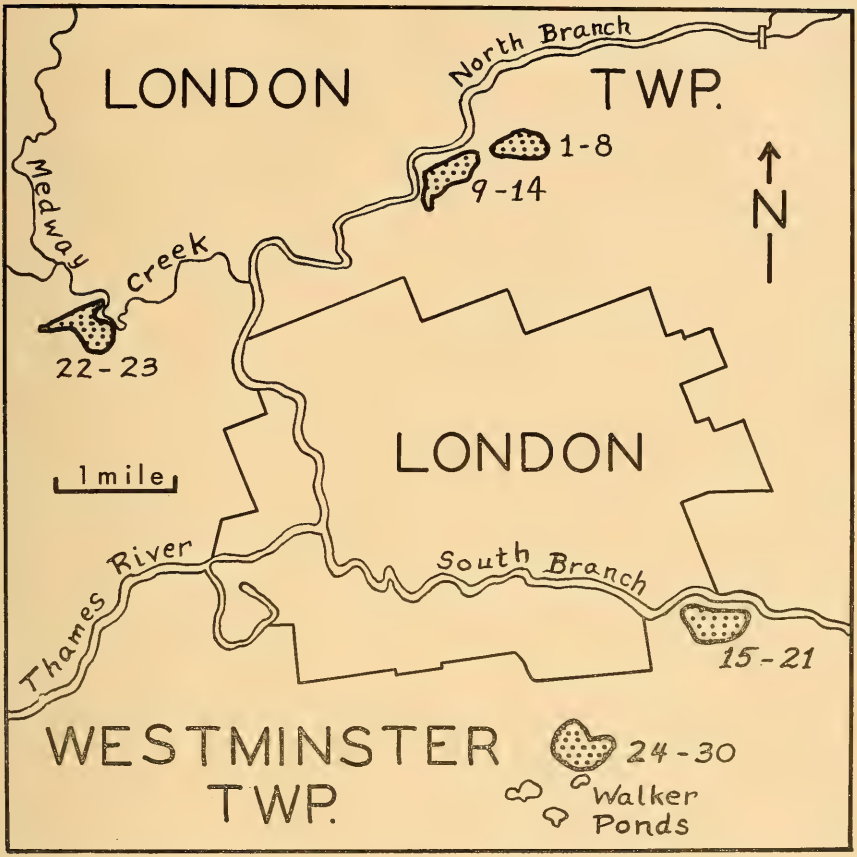

FIGURE 1. Location of woodchuck burrows from which insects were collected in the vicinity of London, Ontario. The stippled areas show the sites at which the burrows were found and the numbers beside the stippled areas are the serial numbers of the burrows.

5. Coleoptera: Staphylinidae: Aleocharinae - 4
   Diptera: Anthomyiidae: *Pegomyia affinis* Stein - 1
   Siphonaptera: Ceratophyllidae: *Orchopeas* (? *howardii* Baker) - 1 ♀
   Hymenoptera: Formicidae: *Lasius neoniger* Emery - 2
6. Coleoptera: Histeridae: *Hister* (? *memnonius* Say) - 4
   Curculionidae: *Barypeithes pellucidus* Boh. - 1
   Hymenoptera: Formicidae: *Leptothorax ambiguus* Emery - 3
7. Coleoptera: Staphylinidae: Aleocharinae - 3
   Histeridae: *Hister* (? *memnonius* Say) - 2
   Scarabaeidae: *Aphodius ruricola* Melsh. - 1
   Aphodius stercorosus Melsh. - 1
   Hymenoptera: Formicidae: *Lasius* sp. - 2
8. Coleoptera: Staphylinidae: Aleocharinae - 1
   Hymenoptera: Formicidae: *Lasius alienus* (Foerst.) - 9

9. Collembola: Isotomidae: *Isotoma viridis* Bourl. - 2
   Entomobryidae: *Tomocerus flavescens* Teb. - 1
   Coleoptera: Staphylinidae: Aleocharinae - 1
   Diptera: Anthomyiidae: *Pegomyia affinis* Stein - 2
   Hymenoptera: Formicidae: *Lasius neoniger* Emery - 8
   Ponera coarctata pennsylvanica Buckley - 1
10. Collembola: Entomobryidae: *Tomocerus* sp. - 1
    Coleoptera: Carabidae: *Calathus opaculus* Lec. - 1
    Elateridae: *Aeolus amabilis* (Lec.) - 2
11. Coleoptera: Carabidae: *Tachys laevus* (Say) - 1
12. Coleoptera: Staphylinidae: Aleocharinae - 5
    Histeridae: *Hister* (? *memnonius* Say) - 3 (in CNC)
    Hymenoptera: Formicidae: *Formica fusca* L. - 1
    Lasius alienus (Foerst.) - 3
13. Coleoptera: Histeridae: *Saprinus* (? *posthumus* Mars.) - 1
    Hymenoptera: Formicidae: *Lasius niger* Emery - 3
    Solenopsis molesta (Say) - 3
14. Coleoptera: Histeridae: *Hister* (? *memnonius* Say) - 1
    Siphonaptera: Ceratophyllidae: *Oropsylla arctomys* (Bak.) - 1 ♂
15. Hymenoptera: Formicidae: *Tapinoma sessile* (Say) - 1
    Lasius neoniger Emery - 1
    Solenopsis molesta (Say) - 8
16. Coleoptera: Histeridae: *Hister* (? *memnonius* Say) - 3 (1 in CNC)
    Hymenoptera: Formicidae: *Lasius alienus* (Foerst.) - 4
17. Coleoptera: Histeridae: *Hister* (? *memnonius* Say) - 1
    Diptera: Anthomyiidae: *Pegomyia affinis* Stein - 1
    Hymenoptera: Formicidae: *Lasius alienus* (Foerst.) - 6
18. Coleoptera: Staphylinidae: Aleocharinae - 3
    Histeridae: *Hister* (? *memnonius* Say) - 2 (1 in CNC)
    Curculionidae: *Brachyrhinus ovatus* (L.) - 1
19. Collembola: Entomobryidae: *Tomocerus flavescens* Tullberg - 1
    Coleoptera: Staphylinidae: *Omalium* sp. - 3
20. Diptera: Anthomyiidae: *Pegomyia affinis* Stein - 1
    Hymenoptera: Formicidae: *Lasius alienus* (Foerst.) - 4
21. Coleoptera: Staphylinidae: Aleocharinae - 1
    Curculionidae: *Brachyrhinus ovatus* (L.) - 1
22. Hymenoptera: Braconidae: *Aspilota* sp. - 15 (8 in CNC)
23. Coleoptera: Nitidulidae: *Glischrochilus q. quadrisignatus* (Say) - 2
    Hymenoptera: Formicidae: *Lasius* sp. - 1
    Solenopsis molesta (Say) - 10
24. Coleoptera: Staphylinidae: *Quedius* sp. - 1
    Aleocharinae - 1
    Diptera: Sciaridae: *Bradysia* sp. - 1 ♀
    Phoridae: *Megaselia* sp. - 1 ♂, 1 ♀ (in CNC)
    Hymenoptera: Ceraphronidae: *Conostigmus* (? *harringtoni* (Ashm.) - 1 (in CNC)
    Formicidae: *Stenamma* sp. - 1
25. Coleoptera: Staphylinidae: *Philonthus* sp. - 1
    Aleocharinae - 1
    Hymenoptera: Formicidae: *Lasius umbratus* (Nylander) - 3
26. Diptera: Sciaridae: *Bradysia* sp. - 1 ♂ (in CNC)
    Phoridae: *Megaselia subciliata* (Mall.) - 1 ♀ (in CNC)

27. Coleoptera: Staphylinidae: ?*Heterothops* sp. - 1
Diptera: Phoridae: *Megaselia subciliata* (Mall.) - 4♀ (in CNC)
Hymenoptera: Ceraphronidae: *Megaspilus* sp. - 1♀ (in CNC)
Formicidae: *Formica lasioides* Emery - 1
28. Coleoptera: Curculionidae: *Brachyrhinus ovatus* (L.) - 1
Siphonaptera: Ceratophyllidae: *Oropsylla arctomys* (Bak.) - 1♀
29. Coleoptera: Staphylinidae: *Boletobius* sp. - 1
Diptera: Phoridae: *Megaselia subciliata* (Mall.) - 1♂ (in CNC)
30. Coleoptera: Silphidae: *Ptomaphagus consobrinus* (Lec) - 1
Staphylinidae: *Quedius* sp. - 1

TABLE 1.—Insects from Thirty Woodchuck Burrows

Insects	Number of Insects	Number of Burrows
Ants (Formicidae)	86	18
Rove Beetles (Staphylinidae)	41	16
Hister Beetles (Histeridae)	23	10
Wasps (Braconidae)	15	1
Humpbacked Flies (Phoridae)	8	4
Springtails (Collembola)	5	3
Flower Flies (Anthomyiidae)	5	4
Root Weevils (Curculionidae)	5	5
Fleas (Siphonaptera)	3	3
Ground Beetles (Carabidae)	2	2
Sap Beetles (Nitidulidae)	2	1
Click Beetles (Elateridae)	2	1
Dung Beetles (Scarabaeidae)	2	2
Wasps (Ceraphronidae)	2	2
Dark-winged Fungus Gnats (Sciaridae)	2	2
Carrion Beetles (Silphidae)	1	1
Dung Flies (Borboridae)	1	1
TOTAL	205	

DISCUSSION OF COLLECTIONS

The numbers of collected specimens are given in Table 1. The most prevalent of the insects were ants, rove beetles and hister beetles, these three groups comprising more than half the insects collected from the burrows. The other groups were present in much smaller numbers.

Collembola

The two identified species of springtails, *Isotoma viridis* and *Tomocerus flavescens*, are both reported by Maynard (1951) to be found in humus, on dead leaves, on the ground and under logs. Their presence in the burrows may not connote any association with woodchucks.

Coleoptera

CARABIDAE

The two ground beetles, *Calathus opaculus* and *Tachys laevus*, are reported by Blatchley (1910) and Hayward (1899) to live under logs in woods and under bark and leaves. As Hayward (1899) records that species of *Tachys* occur in ants' nests, *T. laevus* may have been associated with the ants in the burrows.

SILPHIDAE

One specimen of *Ptomaphagus consobrinus* was found in a burrow. Various species of *Ptomaphagus* have been recorded from a rabbit's nest, from bat guano in a cave, from raccoon dung in a cave and from a dead bat in a cave (Barr, 1958; Blatchley, 1910). It is thus likely that the *P. consobrinus* was associated with the dung in the burrow. Champion (1926) and Marié (1926, record collections of a silphid beetle, *Catops tristis*, from dens of marmots in France. Hamilton (1934) reports that the woodchuck habitually buries its feces in the mound of dirt at the entrance to the burrow. It was from this region that the insects in the present study were collected.

STAPHYLINIDAE

The rove beetles were among the commonest insects, being collected from 18 burrows. Most of them were identified only to the subfamily Aleocharinae. Blatchley (1910) records that beetles of this group live, among other habitats, in excrement and in nests of ants, termites, wood rats and squirrels. It is thus likely that they were associated with the dung in the burrows. The five identified genera, *Omalium*, *Quedius*, *Philonthus*, *?Heterothops* and *Boletobius* are reported by Blatchley (1910) to live in dead leaves, fungi, moss, excrement, etc. Three of the genera, *Philonthus*, *Bolitobius* and *Omalium* have been reported to occur in fungi and on snails at London by Judd (1957, 1957a). Champion (1926) and Marié (1926) record that several species of rove beetles live in nests of marmots in France and the Himalaya Mountains.

NITIDULIDAE

Two specimens of *Glischrochilus q. quadrisignatus* were collected from one burrow. This species is reported to breed in fungi (Parsons, 1943) and has been collected at London from snails by Judd (1957a).

HISTERIDAE

These beetles, *Hister* (*?memnonius*) and *Saprinus* (*?posthumus*) were among the commonest insects present, occurring in 10 burrows. Blatchley (1910) records that histerid beetles occur in logs, fungi, excrement, etc., where they feed on dipterous larvae in these materials. It is likely that the beetles in the burrows fed on larvae of flies in the dung.

ELATERIDAE

Two beetles, *Aeolus amabilis*, were found in one burrow. Larvae of this family occur commonly in soil, where they feed on grass roots (Blatchley, 1910).

SCARABAEIDAE

One *Aphodius ruricola* was found in one burrow and one *A. stercorosus* in another. It is likely that they lived in the dung in the burrows for *Aphodius* occurs in great abundance in excrement (Blatchley, 1910).

CURCULIONIDAE

Both species found in the burrows, *Brachyrhinus ovatus* and *Barypeithes pellucidus*, are root weevils whose larvae feed on roots of grass and other plants (Blatchley and Leng, 1916; Fernald and Shepard, 1942).

Diptera

BORBORIDAE

One *Leptocera* sp. was collected from a burrow. Curran (1934) records that flies of this family occur in decomposing matter and dung. It is thus likely that the *Leptocera* was associated with the dung in the burrow.

SCIARIDAE

Two *Bradysia* sp. were collected from two burrows. Curran (1934) records that larvae of the flies in this family occur on manure. It is thus likely that *Bradysia* was associated with the dung in the burrows.

PHORIDAE

Five *Megaselia subciliata* were collected from two burrows and three *Megaselia* sp. from two burrows. Brues (1950) reports that various species of *Megaselia* have been reared from dead or decaying plant and animal material such as diplopods, ants, caterpillars and snails. It is likely that these flies were associated with such carrion in the burrows.

ANTHOMYIIDAE

Five *Pegomyia affinis* were collected from four burrows. Huckett (1941) records *P. affinis* from groundhog burrows in Maryland and *P. gopheri* from gopher burrows in Georgia. Hamilton (1934) records that *Pegomyia* is found in abundance on practically every woodchuck collected in the summer and that more than a hundred may sometimes accompany a single animal.

Siphonaptera

CERATOPHYLLIDAE

Two *Oropsylla arctomys* were collected from two burrows. The specimens are mounted on slides No. E24.17 and E24.18 in the collection of the Department of Zoology, University of Western Ontario. *O. arctomys* is a true parasite of the woodchuck (Holland, 1949). Hamilton (1934) records many collections of this flea from woodchucks. One *Orchopeas* (?*howardii*) was collected from one burrow. The specimen is mounted on slide No. E24.16. This species is a true parasite of the gray squirrel, *Sciurus carolinensis* (Holland, 1949). Hamilton (1934) reports that occasional occupants of woodchuck burrows include cottontails, skunk, fox, and chipmunk and that it is not unlikely that squirrels and other mammals resort to vacated burrows.

Hymenoptera

BRACONIDAE

Fifteen *Aspilota* sp. were collected from one burrow. Muesebeck and others (1951) record that wasps of the subfamily Alysiinae, to which *Aspilota* belongs, are parasites of Diptera, and Thompson (1953) lists several species of *Megaselia* and *Pegomyia* as hosts of *Aspilota*. It is thus likely that the wasps were parasites of one of these flies in the burrows. This observation is also further evidence that larvae or pupae of *Megaselia* or *Pegomyia* are present in the burrows, for it is commonly the immature stages of insects that are hosts for braconid wasps.

CERAPHRONIDAE

One specimen of *Conostigmus* (?*harringtoni*) was collected from one burrow and one *Megaspilus* sp. from another burrow. Muesebeck and others

(1951) report that host relations of few species in this family are known and that adults are commonly collected by sifting soil litter. The *Conostigmus* may have been associated with the ants in the burrows for Muesebeck and others (1951) record one species of *Conostigmus* from an ant's nest.

FORMICIDAE

Ants were the commonest insects found in the burrows and included the nine species, *Ponera coarctata pennsylvanica*, *Solenopsis molesta*, *Leptothorax ambiguus*, *Tapinoma sessile*, *Lasius alienus*, *L. neoniger*, *L. umbratus*, *Formica lasioides* and *F. fusca* as well as undetermined species of *Stenamma* and *Lasius*. All the ants collected were workers and when found they were moving about over the soil and debris in the burrows. All the species collected are ones that nest in the soil (Muesebeck and others 1951). Several of the workers of *Lasius alienus* were found to be parasitized by the fungus *Laboulbenia formicarum* (Judd and Benjamin, 1959). No particular association between the ants or their colonies and the burrows was noted and it is likely that they were generally foraging about the mouth of the burrows, perhaps for dung or carrion.

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FIELD DATA ON THE MAMMALS OF SOUTHERN SASKATCHEWAN

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Well over 100 years have elapsed since the first scientific inquiries were made concerning the mammals of Saskatchewan. Apparently the earliest records stem from the activities of Richardson and Drummond in the course of the first two Franklin Polar Expeditions. As opportunity permitted, these men observed and collected specimens chiefly at old Fort Carlton and elsewhere along North Saskatchewan River, east and west, between the years 1819 and 1827. In consequence of this work, the type localities of many western mammals are designated as Carlton and Cumberland House, Saskatchewan.

Despite these early beginnings, comparatively little has been published on Saskatchewan mammals. The latest contribution of note is an excellent compilation of Saskatchewan records by Beck (1958), which apparently came off the press some little time after the present paper was completed in early December 1958. Because of the relative scarcity of original field records it seems desirable to supply any additional information of interest and value that may be available.

To this end the present paper chiefly utilizes a lot of personal field data not previously published. The sole purpose of the account is to merely record only my own findings and, particularly, the unpublished data gathered mostly between 1935 and 1948. The material has been extracted from a mass of original field notes gathered at various times and places over a period of more than 30 years. Lack of time and opportunity prevented the completion of this paper at an earlier date.

Some of my Saskatchewan results were published earlier; these are listed in the references. For greater comprehensiveness, it now seems desirable to consolidate all key records in a single paper where such a presentation serves to throw more light on questions of distribution and other points. Occasional oral statements of others have been used when considered reliable. This is not a list of all mammals known to inhabit the southern half of Saskatchewan. For example, only one species of bat was personally collected and suitably identified. Personal records do not pretend to go beyond about latitude 54°, although a few incidental statements refer to points somewhat farther north.

My Saskatchewan investigations were carried out in the following areas: Broadview, 1914 and 1921; along the international boundary, August 9 to October 17, 1927 (Soper, 1946); Birchbark and Harper lakes, November 17 to December 14, 1927; and in most districts of the southern half of the province from 1935 to 1948. During the latter period the work was intermittently conducted from the Winnipeg office of the Canadian Wildlife Service.

The annotated notes are partially based upon the 535 mammal specimens taken in Saskatchewan in a total of about 13,000 trap-nights. With a few minor exceptions, the specimens are now part of the permanent collections of the National Museum of Canada, Ottawa, and the Department of Zoology, University of Alberta, Edmonton.

Measurements are given in millimeters in the order of total length, tail vertebrae and hind foot. Available weights are expressed in grams, except for the larger species where pounds are adopted. Scientific terminology and sequence of species follow Miller and Kellogg (1955), except for *Sorex vagrans soperi* where Findlay's (1955) usage is employed. With a view to near uniformity for Saskatchewan forms, vernacular names are substantially those used by Anderson (1946).

ACKNOWLEDGMENTS

I wish here to gratefully mention the facilities offered by the Canadian Wildlife Service that directly, or indirectly, made possible the gathering of much of the information that follows. For valuable assistance throughout the years involved I am greatly indebted to Dr. R. M. Anderson (then Chief, Biological Division, National Museum of Canada) who assumed the task of making subspecific determinations of all specimens taken and providing extensive analytical comments in connection with them. Much appreciated help was also received from the superintendent and wardens of Prince Albert National Park and the Game Branch, Surveys Branch and Provincial Museum, Government of Saskatchewan, Regina.

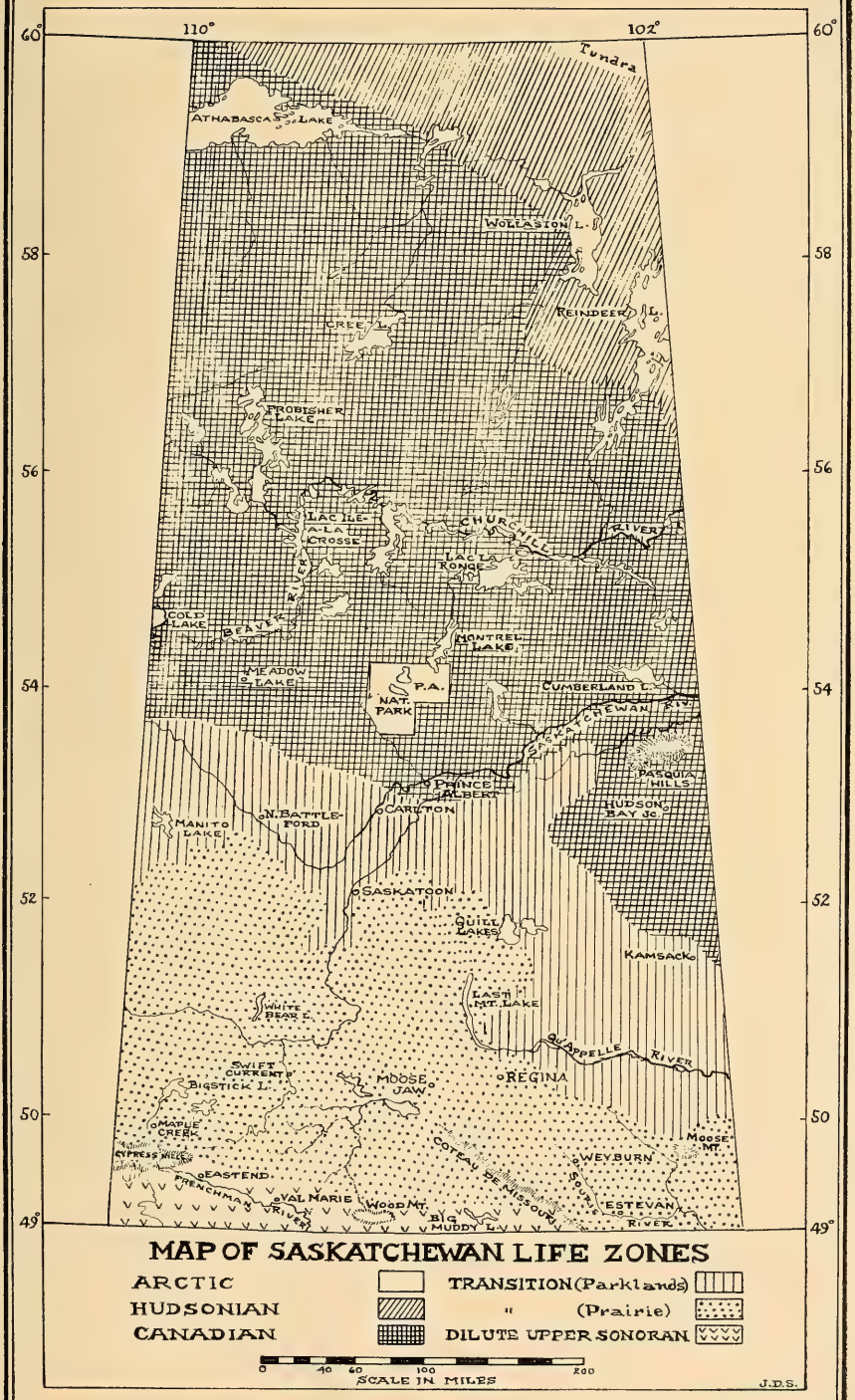
PHYSIOGRAPHICAL NOTES

The region under review is roughly the area south of latitude 54°, or through an airline distance of 350 miles north from the international boundary. The width of Saskatchewan at the southern border is about 390 miles, extending from approximate longitude 102° to 110° W. By far the greater part of this territory lies on the third prairie steppe of the Great Plains. A minor portion on the second steppe extends eastward from the Missouri Coteau into Manitoba. Average elevations in the region vary from around 1600 feet in the north to 1200 feet in the southeast and nearly 3000 feet in the southwest.

Most of this vast plain (exclusive of badlands, river trenches and coulees) is gently to moderately rolling; some sections are nearly flat. The topography is interrupted at intervals, however, by rounded ridges up to several hundred feet in height. One of the most notable features of the region is Cypress Hills (4280 feet); lesser eminences include Wood and Moose mountains and Touchwood and Pasquia hills. The northern terrain beyond the parklands is generally more strikingly glaciated, rugged, heavily forested and strewn with a multitude of lakes, streams and muskegs.

Principal waterways intersecting the prairie-parkland area are North and South Saskatchewan, Qu'Appelle, Red Deer, Carrot, Souris and Frenchman rivers. Southern shortgrass country, notably on the Missouri drainage, is largely devoted to ranching. Most of the remaining lands, north to about latitude 53°, are under cultivation, although they are often interrupted by scattered, primitive areas unfit for agriculture. (For more extended description see Soper, 1946.)

FIGURE 1. Map of Saskatchewan showing the various faunal life zones. ⟶


110°
102°
60°
58°
56°
54°
52°
50°
49°
Tundra
ATHABASCA L.
WOLLASTON L.
REINDEER L.
CREE L.
PROBISHER LAKE
LAC LA CROSSE
CHURCHILL RIVER
LAC LA RONGE
COLD LAKE
BEAVER
MONTREAL LAKE
MEADOW LAKE
P.A. NAT. PARK
CUMBERLAND L.
SASKATCHEWAN RIV.
PASQUA HILLS
PRINCE ALBERT
CARLTON
N. BATTLEFORD
MANITO LAKE
HUDSON BAY Jc.
SASKATOON
QUILL LAKES
KAMSACK
LAST MT. LAKE
WHITE BEAR L.
QU'APPELLE RIVER
SWIFT CURRENT
BIGSTICK L.
MOOSE JAW
REGINA
MAPLE CREEK
CYPRESS HILLS
EASTEND
FRENCHMAN RIVER
VAL MARIE
WOOD MT.
COTEAU DE MISSOURI
BIG MUDDY L.
WEYBURN
MOOSE MT.
ESTEVAN
SOURIS RIVER
MAP OF SASKATCHEWAN LIFE ZONES
ARCTIC
HUDSONIAN
CANADIAN
TRANSITION (Parklands)
" (Prairie)
DILUTE UPPER SONORAN
0 40 60 100 200
SCALE IN MILES
J.D.S.

FAUNAL LIFE ZONES

Brief reference to the life zones is desirable because of frequent mention of them, in relation to distribution, in the accounts of species (see Figure 1). All zones of the province are depicted here for general clarification of the subject, although the Hudsonian and Arctic Life zones are beyond the scope of this paper.

In the extreme southwest, immediately north of the 49th parallel, conditions exist that despite their dilute character are clearly referable to the Upper Sonoran Zone (Figure 2). Here the various elements of this zone are near their northern limits and soon taper off into the semiarid part of the Transition Zone to the north. Among other things, aridity is especially pronounced in the area from southeastern Alberta (exclusive of Cypress Hills) east to the Missouri Coteau, particularly on the Frenchman River drainage. In this territory Upper Sonoran plant and animal indicators are clearly discernible. Among the characteristic mammals are *Cynomys ludovicianus*, *Peromyscus leucopus aridulus*, *Perognathus fasciatus fasciatus*, *Sylvilagus nuttallii grangeri*, *Dipodomys ordii terrosus* and *Mustela nigripes*.

Immediately to the north a subtle merging takes place with the treeless grasslands of the Transition Zone (Figure 3). The lower reaches are marked by rather scanty rainfall, but precipitation gradually increases northwards over the more humid prairies and aspen poplar parklands (Figure 4). In general, this province-wide, prairie-parkland belt has an average width of about 130 miles.

Bordering the Transition Zone on the north is the mixed-wood forest of the Canadian Zone (Figure 5). Its irregular southern edge extends from about latitude 52°, in the east, to about North Saskatchewan River at the Alberta border; the northern extremity angles from Reindeer Lake northwest to the vicinity of Athabasca Lake. This northern section is clothed with a typically boreal forest of conifers, poplars and paper birch, interspersed with lakes, cool, grassy bogs and muskegs. It is the natural home of most big-game species and the valuable fur bearers.

The stunted woods of the Hudsonian Zone occupies most of the remainder of the province. A small area of Arctic tundra occurs in the extreme northeastern corner where tree growth finally disappears except in some sheltered depressions.

ACCOUNTS OF SPECIES

CINEREOUS SHREW *Sorex cinereus cinereus* Kerr. Generally but sparingly distributed in the Hudsonian and Canadian zones and northern fringe of the Transition parklands. In some localities and seasons it appears to be rare or absent, while again at times it is locally common. Average rate of capture was somewhat less than one per 200 trap-nights; the highest recorded was six in 100 trap-nights. Proof of occurrences was personally obtained only at Prince Albert National Park and Harper and Birchbark lakes. Four examples average 93.5, 34.2, 11.4 (92, 29, 10.5–95, 38, 12) mm; weight, 3.5 (3.3–3.9) grams.

HAYDEN CINEREOUS SHREW *Sorex cinereus haydeni* Baird. Normal habitat lies in the aspen grove belt, but *haydeni* also occurs very sparingly in shrubby, treeless plains to the south. Little success came of trapping for it in Saskatchewan. A female was captured at Highfield Reservoir, seven miles south of Rush Lake, on July 20, 1946; measurements: 88, 33, 11.5 mm; 4.2 grams. It is known to inhabit the wooded Cypress Hills. A rancher, Mr. George Ecker, stated

FIGURE 2. Sagebrush flat in Battle Creek Valley two miles south of Supreme. Typical habitat of sagebrush and badlands meadow voles and prong-horned antelope. Dilute Upper Sonoran Zone.

FIGURE 3. Prairie landscape along Arm River, southeast of Girvin, illustrating treeless grasslands of the Transition Zone.

that he had seen near Duncairn Reservoir and along Swift Current Creek very small shrews, which are doubtless referable to this race.

SADDLE-BACK SHREW *Sorex arcticus arcticus* Kerr. Typical habitat comprises wet margins of lakes and marshes, damp willow-alder associations and muskegs in the northern coniferous forest. Geographic distribution is very extensive, but locally erratic; in any event, it is usually uncommon or wanting. In most cases average rate of capture was only one per 100 trap-nights, or less. Five specimens preserved in Prince Albert Park (Crean and Amyot lakes) averaged 124, 40, 14.1 (118, 38, 13.3—140, 40, 14.5) mm; 9.1 (8.1—10.6) grams.

PRAIRIE DUSKY SHREW *Sorex vagrans soperi* (Anderson & Rand). The type specimen was taken by the writer near Lake Audy, Riding Mountain National Park, Manitoba, on September 21, 1940. Two months earlier a female was secured near Trapper Lake, Prince Albert Park (108, 44, 12 mm) and a male in June, 1941, at Middle Creek, about 14 miles northwest of Govenlock (113, 46, 13.6 mm). A fuller account is given in an earlier paper (Soper, 1946). So far as known, this form occurs only in Cypress Hills, and vicinity, and along the upper limits of the Great Plains in the southern fringe of the Canadian Zone. (Findley, 1955, refers specimens from Cypress Hills district to *S. v. obscurus*.)

AMERICAN WATER SHREW *Sorex palustris palustris* Richardson. Mixed-wood forest is the typical environment of *palustris*, but it is found occasionally along streams and lakes within the northern limits of the Transition parklands. In general, it appears to be rather scarce, or rare, but in exceptional surroundings it may be fairly common. It is to be looked for almost anywhere along waterways in the northwoods, but comparatively few specimens are trapped. I secured only one Saskatchewan specimen: a male taken in Prince Albert Park on July 18, 1940, measuring 151, 63, 19 mm.

MANITOBA SHORT-TAILED SHREW *Blarina brevicauda manitobensis* Anderson. A relatively new subspecies, the type specimen of which I collected on October 29, 1927, at Max Lake, Turtle Mountain, Manitoba (Anderson, 1946 p. 23-24). It was long suspected that *Blarina* might occur in southeastern Saskatchewan. In May, 1942, at a farmer's house near Antler, I saw one that had been caught and badly mutilated by a house cat. Since that time several have been recorded in the southeastern part of the province.

LITTLE BROWN BAT *Myotis lucifugus lucifugus* (Le Conte). In suitable places, ranges throughout most of the Transition and Canadian zones. Four females were collected in a building at Waskesiu, Prince Albert Park, on July 14, 1940. These averaged 102, 41, 12.7, ear 16.1, tragus 8.9 (101, 40, 12.5, 15.5, 8.5—106, 42, 13, 17, 9) mm. Sight recordings and oral reports of small bats, believed referable to *lucifugus*, were obtained for the vicinity of Whitewood, Quill Lakes, Maple Creek, Ravenscrag and Middle Creek.

WHITE-TAILED JACK RABBIT *Lepus townsendii campanius* Hollister. Type locality: probably near Carlton House. Regularly inhabits the whole of southern Saskatchewan north to the upper limits of the Transition parklands. Exceptional stragglers even work their way farther north into scattered grasslands of adjacent boreal forest. As an example, several were noted in 1942 in southern Prince Albert Park and another during April 1945 running on the ice of Waskesiu Lake.

In the course of wide travels I saw the animals in innumerable localities practically throughout their provincial range. Status is punctuated by marked numerical fluctuations. At times the species becomes so scarce that very few are to be seen over far-flung reaches of the plains. On occasion, it appears to become much more numerous on the high, shortgrass terrain of the third prairie steppe than in other localities. When plentiful, a high toll is taken by motor cars on main highways. Details of two specimens collected at Val Marie and Big Muddy Lake, respectively, are: female, 615, 80, 135 mm, 7 lb.; females, 620, 70, 150 mm; 8 lb.

AMERICAN VARYING HARE *Lepus americanus americanus* Erxleben. A habitual and at times abundant resident of the entire boreal forest and neighboring parklands to the south. It also occurs locally on Moose and Wood mountains and Cypress Hills, as well as various wooded or brushy stream valleys intersecting the treeless plains. In consequence, it occupies locally favorable habitats all the way from dilute Upper Sonoran, in the southwest, to the vast uninterrupted reaches of wooded Transition and Canadian zones of the north.

FIGURE 4. Scene at one of the Fishing lakes, west of Fort Qu'Appelle, looking southeast. Mixed prairie and poplar woods of the Transition Zone parklands, or aspen grove belt.

FIGURE 5. South end of Crean Lake, Prince Albert National Park, deep within the northern coniferous or mixed-wood forest of the Canadian Life Zone.

Over the greater part of Saskatchewan the periodic cycle of abundance appeared to have reached its peak in 1932-33 and 1941-42; crash declines occurred in the following years. Absolute maxima are not reached simultaneously in all parts of the territory; during this stage, variations in relative abundance are easily discernible in different districts. Average measurements and weight of 12 specimens taken at Battle Creek, Val Marie, and Harper and Birchbark lakes are: 425, 26, 129 (370, 21, 100—480, 31, 147) mm; 2.6 (1.5—3.5) lb.

MINNESOTA VARYING HARE *Lepus americanus phaeonotus* Allen. This race occupies only a small area on the second prairie steppe in the southeast corner of the province, the western limits of a much larger range to the east. Hares from Moose Mountain and north, and west of Missouri Coteau (on the third prairie steppe), are referable to *americanus*. Three specimens taken at Glen Ewen in mid-October 1927 have been referred to the present form; these average 375, 25.7, 106 mm; 2.2 lb.

NEBRASKA COTTONTAIL *Sylvilagus floridanus similis* Nelson. Occurs at least sparingly in the extreme southeastern corner of the province. I saw none in 1927, but in May 1942, one was personally spotted near Antler Creek, west of Gainsborough—evidently the first reliable record for Saskatchewan. During the same day, farmers assured me that in recent years cottontails had appeared in the Souris River valley below Glen Ewen and Oxbow and that a few had spread northward to about the southern flank of Moose Mountain.

BLACK HILLS COTTONTAIL *Sylvilagus nuttallii* (Allen). Chiefly inhabits brushy badlands coulees and ravines on the third prairie steppe from about Big Muddy Lake west into Alberta. Of late years cottontails have slowly spread northwards; prevailing northern limits of range were not ascertained, but it has been recorded at least as far north as Dundurn.

Collectively, five adults were taken at Eastend, Val Marie, Frenchman River (Lat. 49°), Rocky Creek and Big Muddy Lake; these average: 374, 35, 92 (355, 25, 84—380, 43, 98) mm; 999 (681—1,362) grams. Two Eastend subadults collected on August 21 are as follows: 235, 25, 55 mm, 567 grams and 310, 32, 81 mm, 454 grams. Cottontails were also seen at Lodge Creek, Govenlock, Middle Creek Reservoir, Battle Creek and Frenchman River south of Dollard.

CANADA WOODCHUCK *Marmota monax canadensis* (Erxleben). Distributed in varying degrees of abundance throughout wooded Transition and Canadian zones. Observed in many localities from Moose Mountain north, and northwest to Cold Lake. In numerous places, of ostensible suitability, the species appears to be either extremely scarce or absent. It was detected nowhere on the southwestern treeless plains. A female collected at Spruce River, Prince Albert Park, measured 530, 118, 76 mm and weighed 6.3 lb.

BLACK-TAILED PRAIRIE DOG *Cynomys ludovicianus ludovicianus* (Ord). First discovered in Canada by the writer near Val Marie on August 28, 1927. Subsequently, more personal investigations in 1937 and 1941 disclosed five additional 'towns' along Frenchman River valley; these were distributed from 'Prairie Dog Buttes' (7.5 miles southeast of Val Marie) to Breed Creek, a few miles north of the international boundary (Soper, 1938, 1944, 1946). Associated conditions are closer to Upper Sonoran than semiarid Transition. Average measurements of seven adults are: 381.7, 81.6, 62.3 (350, 82, 63—400, 90, 64) mm; mean weight: 1,026 (684—1,368) grams. A juvenile collected on July 7, 1937, measured 273, 60, 55 mm.

RICHARDSON GROUND SQUIRREL *Citellus richardsonii richardsonii* (Sabine). These hardy and practically ubiquitous creatures locally occupy the whole of southern Saskatchewan north to the Canadian Zone. However, density of population can, and does, vary markedly in different parts of the range. They are commonly more numerous on the shortgrass plains than in the aspen grove belt. In a number of places the species has pushed northward to isolated patches of prairie within the mixed-wood forest. Examples include colonies near Christopher Lake and in grasslands of southwestern Prince Albert Park as far north as Kiyam Lake. Seven examples secured at Val Marie, Frenchman River (east of Orkney), Wood Mountain and Carlton (type locality) average 297, 74, 45 (270, 70, 42—325, 87, 47) mm; 257 grams.

STRIPED GROUND SQUIRREL *Citellus tridecemlineatus tridecemlineatus* (Mitchill). Ranges over the parklands of the second and third prairie steppes from the southeastern corner of the province, north, and northwest

to Alberta. Distribution is spotty and relative abundance highly diversified. Three male specimens taken at Broadview in May, 1921, measure 250, 85, 40; 270, 83, 38; and 275, 95, 38 mm. Other recorded points of occurrence include Oxbow, Estevan, Moose Mountain, Langbank, Crooked Lake (Qu'Appelle Valley), Canora, Big Quill and Last Mountain lakes, Chamberlain, Outlook and Battleford.

PALE STRIPED GROUND SQUIRREL *Citellus tridecemlineatus pallidus* (Allen). Confined to a restricted range in the extreme southwest where it is capriciously dispersed and scarce. Most have been collected, or seen, in the Cypress Hills (Cypress and Elkwater lakes, Kealey Springs and Little Frenchman Creek). There is an unconfirmed report of occurrence at Big Muddy Coulee; if correct, the animals there may be intergrades between *pallidus* and *tridecemlineatus*.

NORTHERN STRIPED GROUND SQUIRREL *Citellus tridecemlineatus hoodii* (Sabine). This darker-colored race occupies a belt of country north of the range of *tridecemlineatus* from the latitudes of Riding Mountain and Swan River, Manitoba, northwest to at least Prince Albert Park. The full extent of its range is not yet known. *Hoodii* lives in two distinct environments: the northern margin of the aspen grove belt, and localized areas within the neighboring mixedwood forest. It inhabits southern tracts of prairie and grassy forest glades all across Prince Albert Park and north, sparingly, to Waskesiu Lake and the south end of Crean Lake. It also occurs at Namekus, Montreal and Emma lakes and south to the Carlton type locality.

Individuals noted at Basin, Middle, Lenore and Ponass lakes also may be referable to this form. Four adults taken at Spruce River and Namekus Lake averaged 284, 100, 36.5 (270, 92, 30—292, 106, 39) mm; 178.7 (170—183.8) grams. Details of two immatures collected at the former locality on July 7 are: 213, 74, 36 mm, 131.1 grams. and 210, 73, 35 mm, 134.4 grams.

FRANKLIN GROUND SQUIRREL *Citellus franklinii* (Sabine). A more or less familiar resident of the Transition parklands from southeastern and east-central localities westward into Alberta. Local dispersal and numbers are noticeably irregular—sometimes common, scarce, or apparently wanting. There is a certain amount of infiltration by the animals of contiguous Canadian Zone such as at Christopher and Emma lakes and Prince Albert Park. In the latter district *franklinii* was seen as far north as the south end of Crean Lake (Lat. 54°).

Other points of personally observed occurrences include Dead Lake (Souris valley); Moose Mountain; Lac la Course; Tisdale; Quill, Waterhen, Lenore, Basin, Redberry and Red Fox lakes; Spiritwood; Battleford and Manito Lake. Five specimens, in all, were collected at Broadview, Mery Creek, Carlton (type locality) and Prince Albert Park; these averaged 366, 127, 53.6, (355, 120, 50—375, 131, 55) mm. Two individuals weighed 464 and 511 grams.

LITTLE NORTHERN CHIPMUNK *Eutamias minimus borealis* (Allen). Occurs generally throughout the aspen grove belt and indefinitely northwards in the Canadian Zone. It also inhabits Cypress Hills. Local habitat preferences often produce some very obvious differences in population densities. Fifteen adults from Moose Mountain, Broadview, Qu'Appelle Valley, Mery Creek, Prince Albert Park, Fort Walsh and Battle Creek have the following mean measurements: 208, 91, 31.6 (170, 72, 30—216, 100, 34) mm; average weight: 46.6 (36.5—61.5) grams. A female taken at Moose Mountain on May 21, 1942 (weight: 61.5 grams), contained seven fetuses averaging 17 mm in length. Regarding specimens from the Cypress Hills area, there appears to be some approach to the paler race *E. m. pallidus* (Anderson, 1946: 199).

HUDSON BAY RED SQUIRREL *Tamiasciurus hudsonicus hudsonicus* (Erxleben). Full extent of its eastern Saskatchewan range has not been clearly ascertained. However, typical examples, or intergrades with *preblei*, occur in the extreme east-central areas of the province and ostensibly over a widening territory to the north and northwest. *Hudsonicus* is the form occurring in adjacent districts of Manitoba from Riding and Duck mountains to Saskatchewan River. A male from Moose Mountain, tentatively referred to the present race, measures 325, 130, 48 mm; weight: 168 grams. Others seen in lower Qu'Appelle Valley and along Assiniboine River are probably *hudsonicus*, or nearer to it than *preblei*.

MACKENZIE RED SQUIRREL *Tamiasciurus hudsonicus preblei* Howell. This, the common red squirrel of the Canadian Zone occurs locally south in the aspen grove belt to about the latitude of Carlton. The population in extreme eastern Saskatchewan is considered nearer to the form *hudsonicus*.

Average measurements of five specimens collected at Prince Albert Park and Harper Lake are 321, 124, 49 (318, 118, 48—324, 132, 50) mm. Average weight of adults is about 240 grams. Red squirrels were also observed near the headwaters of Carrot Creek; at Birchbark and Christopher lakes; Big River, and points west.

HUDSON BAY FLYING SQUIRREL *Glaucomys sabrinus sabrinus* (Shaw). Regarded as an inhabitant of the whole boreal forest north of Saskatchewan River and south of Cumberland House. Little information is available for this region and few specimens are extant. Repeated efforts to secure summer specimens in widespread northern localities were made without success. Nevertheless, the animals are obviously more numerous than these endeavors would suggest, for trappers almost invariably assert that numbers are accidentally caught every winter in trap-sets designed for larger fur-bearers. I have dependable records of occurrence for at least Birchbark and Harper lakes, several localities in Prince Albert Park and at Meadow Lake. Flying squirrels reported at Moose Mountain are probably *G. s. canescens*.

RICHARDSON POCKET GOPHER *Thomomys talpoides talpoides* (Richardson). So widespread is *talpoides* within the province that it could, with propriety, be called the Saskatchewan pocket gopher. Type locality is Carlton House. Regional occupation embraces all of the aspen grove belt, some of the treeless prairie to the south, and various tracts in the lower reaches of the Canadian Zone. Its presence was recorded in innumerable places from Qu'Appelle River northward to Canora; Tisdale; Quill, Lenore and Basin lakes; Carlton; Prince Albert Park and westward to Alberta.

While common to abundant in some areas, it is totally absent in others of apparently equal suitability. Three females taken near Lac la Course in late May 1942 measured and weighed as follows: 217, 68, 29 mm, 137.2 grams; 211, 65. 27.5 mm, 110 grams; and 220, 63, 27.5 mm, 138 grams. The first carried five 18 mm fetuses and the last, six fetuses averaging 32 mm in length. From August 21 to 24, 1942, three subadults taken at Sugar Creek, Prince Albert Park, averaged 195, 54, 26 mm; mean weight: 93 grams.

DAKOTA POCKET GOPHER *Thomomys talpoides rufescens* Wied-Neuwied. Occurs sparingly on the second prairie steppe in the extreme southeast, west to about the Missouri Coteau. An adult female (200, 43, 28 mm) from Glen Ewen and a subadult female taken at Red Fox Lake, near Kendall, were assigned to this race by Anderson (1946: 129). Signs of pocket gophers, presumably of this form, were also noted at Kisby, Moose Mountain and Kipling.

SAGEBRUSH POCKET GOPHER *Thomomys talpoides bullatus* Bailey. Apparently restricted to a relatively small territory in the extreme southwestern corner, with positive records of occurrence at Cypress Hills, Ravenscrag, Dollard and Eastend. A rancher northeast of Kealy Springs stated that pocket gophers (doubtless *bullatus*) once tenanted land now covered by Duncairn Reservoir, Swift Current Creek. North of the Montana border it is one of the rarest of mammals inhabiting the Missouri watershed.

Local habitat comprises streamside bottomlands; arid coulees, slopes and benchlands clothed with sagebrush and other vegetation; woodland glades in Cypress Hills; and fields of alfalfa and other feed. Average measurements of four specimens taken near Eastend in late August, 1927; are: 195, 59, 28.2 (180, 54, 27—205, 65, 30) mm; no weights available.

MAXIMILIAN POCKET MOUSE *Perognathus fasciatus fasciatus* Wied-Neuwied. Until comparatively recent years there were no records of this species in Saskatchewan, but it was known to occur in southwestern Manitoba; the first specimens were collected in southeastern Alberta in the summer of 1951. In 1927 I secured no hint of its presence along the international boundary. Later, Mr. Fred Bard, Director, Provincial Museum, Regina, stated in a letter that they had two Saskatchewan records: a female taken on November 25, 1925, at Baildon, and a male from Mortlach captured on August 25, 1928. In 1937 I saw unmistakable signs of burrows of *Perognathus* at Red Fox Lake and again, in 1946, along Swift Current Creek south of Gull Lake.

MONTANA KANGAROO RAT *Dipodomys ordii terrosus* Hoffmeister. I was unable to find this species or any report of it along the international boundary in 1927. It was first recorded from Shackleton in 1933 and the following year another was found near Tompkins (Anderson, 1946: 131). While visiting Bigstick Lake in 1937 I met a farmer who described a small mammal seen near there that perfectly fitted this species. During the same season, foot prints and tail impressions in sandy soil, near Bitter Lake, were interpreted as almost certainly those of a kangaroo rat.

CANADA BEAVER *Castor canadensis canadensis* Kuhl. Occurs, or formerly occurred, in the aspen grove belt from Souris River north and west, and throughout the Canadian Zone to the north. Earlier in the century the species suffered extirpation in many of its more southern haunts and acute reduction in population elsewhere. More recently restorative measures have offset this trend. The animals are now increasing in numbers and again spreading into districts where they had long been absent. A good example of beaver abundance is to be found in Prince Albert Park.

MISSOURI RIVER BEAVER *Castor canadensis missouriensis* Bailey. In Saskatchewan, confined to the high semiarid plains of the southwest from about Wood Mountan to Cypress Hills. Occurrences were recorded in the latter area and along such discharging streams as Middle, Battle, Little Frenchman and Maple creeks. The animals are less plentiful to the east, but sparingly inhabit Frenchman River from its source at Cypress Lake to the international boundary. They were also found at Morgan and Rocky creeks, south of Wood Mountain.

An adult male secured at Battle Creek measured 1, 040, 340, 180 mm and weighed 37.5 lb. Three subadults collected at Rocky Creek, September 14-15, 1927, averaged 733, 258, 137 mm and 13.7 lb. None was detected east of there on the Missouri watershed, but local rumors indicated that beavers at least formerly occurred near Harptree, Big Beaver and along Big Muddy Creek.

BOREAL WHITE-FOOTED MOUSE *Peromyscus maniculatus borealis* Mearns. This is the 'whitefoot' of the northern coniferous forest and adjoining parklands. To the south, subtle intergradation takes place with *osgoodi*, and to the southeast with *bairdii*. In the latter area a puzzling mixture of coloration evolves with various differentials and combinations of all three forms. Most individuals along the eastern border, from Souris River to at least lower Qu'Appelle Valley, reflect this complex, but on the whole have somewhat closer affinities with *osgoodi*.

Peromyscus is usually common and the most abundant of indigenous small mammals. However, at various times and places it may be quite scarce, as during the period 1941-43. Curiously enough, this condition is not simultaneous throughout the range, for scarcity and abundance can prevail in different areas during the same season. A case in point was the extraordinary abundance of these mice in parts of Prince Albert Park, in 1943, where the capture rate vaulted as high at 72 per 100 trap-nights, whereas in some other areas it sank to one or two or less. Maximum abundance was found on islands in the larger lakes.

The mean measurements of 51 examples from Last Mountain and Harper lakes, Carlton, and Prince Albert Park are 164.4, 70.5, 20.1 (155, 62, 19—185, 78, 21.5) mm. Average weight of 23 individuals: 23.9 (18.5—36.5) grams. The last given weight was that of a gravid female taken on June 9, carrying six well-developed fetuses.

OSGOOD WHITE-FOOTED MOUSE *Peromyscus maniculatus osgoodi* Mearns. For the most part, an inhabitant of the dry southern plains, ranging from the Upper Sonoran Zone to the Transition at about the southern margin of the aspen grove belt. Here it gradually merges with *borealis*. On the second prairie steppe, in the southeast, there is almost imperceptible intergradation with the darker eastern form *bairdii*; practically typical examples persist about as far east as Glen Ewen. *Bairdii* characters become increasingly noticeable east of about longitude 102° W (Soper, 1946).

Remarks under *borealis* as to variations in population levels apply equally well here. Specimens assigned to *osgoodi* were collected at Battle, Middle and Swift Current creeks; Cypress, Fife, Tenaille and Big Muddy lakes; Chaplin; Eastend; Val Marie; Frenchman River (49°N); Rocky Creek; McDonald and Dead lakes; Glen Ewen; Kendal; Langbank; and Crooked and Pasqua lakes, Qu'Appelle Valley. At all points from lower Souris River to Qu'Appelle River, individuals exhibit various degrees of approach to *bairdii*. Average measurements of 124 specimens from the above localities are: 153.1, 61.7, 19.9 (137, 52, 17.5—175, 74, 21) mm. Mean weight of 34 individuals: 23.2 (18.5—32.1) grams.

BADLANDS WHITE-FOOTED MOUSE *Peromyscus leucopus aridulus* Osgood. A comparatively scarce Upper Sonoran species that apparently occurs in Saskatchewan only on the semiarid plains of the Missouri watershed. In Canada, it ranges on the third prairie steppe from southern Alberta east to the Missouri Coteau in about longitude 103°30′ W. Sagebrush and greasewood are normal components of the habitat; streamside thickets are also utilized. Common associates in this environment are sagebrush voles and Osgood white-footed mice. Especially in

comparison with the latter species, *aridulus* is thinly dispersed; rate of capture in its range was about one to every 12 *osgoodi*. A series of nine specimens was collected at Eastend, Rocky Creek and Big Muddy Lake, respectively; average measurements are 169.4, 70.2, 20.4 (154, 62, 20—180, 75, 21) mm.

AUDUBON GRASSHOPPER MOUSE *Onychomomys leucogaster missouriensis* (Aud. & Bach.). Capriciously and thinly distributed on the western part of the second prairie steppe in southeastern Saskatchewan, on the high semiarid plains to the west, and north into the Transition Zone to about latitude 53°. Four specimens taken near Kendal, Val Marie and Swift Current Creek (south of Webb) average 127, 34, 20.4 mm. One from the latter point weighed 31.1 grams. Other recorded points of capture include Wood Mountain, Weyburn, Indian Head, Touchwood Hills, Last Mountain Lake, Dundurn, Carlton and Cypress Hills.

GRAY BUSHY-TAILED WOOD RAT *Neotoma cinerea cinerea* (Ord.). In the course of wildlife investigations along the international boundary, I obtained first-hand information regarding these animals only along Milk River in southern Alberta. However, in a letter from Mr. Fred Bard, Provincial Museum, Regina, dated January 24, 1951, it was revealed that some little time previously a wood rat had been captured at Govenlock. It was reported as occurring only casually and at wide intervals. The species is essentially a dweller in the Rocky Mountains, but stragglers infiltrate suitable Great Plains environment to a very limited extent.

MANITOBA LEMMING VOLE *Synaptomys borealis smithi* Anderson & Rand. From a wide Canadian Zone distribution in Manitoba, *smithi* ranges westward in the boreal forest of Saskatchewan as far, at least, as Prince Albert Park. It evidently meets the range of *S. b. borealis* at a moderate distance to the west and northwest. Little is known about it in this province. On July 16, 1940, I trapped a male *smithi* in a bog near the west boundary of Prince Albert Park, east of Nesslin Lake, measuring 118, 23, 17.5 mm.

ATHABASCA RED-BACKED VOLE *Clethrionomys gaperi athabascae* Preble. Occurs in Hudsonian and Canadian zones south to the general vicinity of the northern parklands where it intergrades with *C. g. oringi*. Twelve specimens collected at Harper Lake and Prince Albert Park average 138.6, 36.8, 17.8 (134, 20, 16—142, 39, 18) mm; 24.6 (20.9—28-5) grams. Some specimens from the southern pseudoprairie section of the park resemble *loringi* in brightness of the dorsal area and were so listed in my 1952 report; on the whole, however, it is now considered that the 'redbacks' of that area are nearer to the present race.

PLAINS RED-BACKED VOLE *Clethrionomys gapperi loringi* (Bailey). A highly adaptable rodent, ranging from the dilute Upper Sonoran Zone in the southwest, north through the parklands and slightly into the southern limits of the mixed-wood forest, where it intergrades with *athabascae*. In the semiarid plains region *loringi* evidently occurs only in the extreme southwest; there it resides in Cypress Hills and in thickets along closely associated coulees and streams. A total of 44 specimens was collected in the following localities: Glen Ewen, Red Fox Lake, Langbank, Mery Creek, Carlton, Eastend, Battle Creek and Cypress Hills; these average 135.3, 35.1, 18.6 (125, 27, 16—164, 45, 20) mm; mean weight of 16 examples: 24.1 (19.9—26.3) grams.

PRAIRIE PHENACOMYS *Phenacomys ungava soperi* Anderson. The dearth of information for this animal in Saskatchewan closely parallels that of *S. b. smithi*. Its range is given as "forested areas on edge of northern Great Plains region" (Anderson, 1946: 151) from Riding Mountain through south-central Saskatchewan to south-central Alberta. An immature female was personally collected at Sugar Creek, Prince Albert Park, on August 24, 1942, measuring 113, 26, 27 mm; 14.4 grams. It was frequenting a hillside poplar woods containing scattered spruce and a wealth of undergrowth, rotting tree trunks and other litter.

DRUMMOND MEADOW VOLE *Microtus pennsylvanicus drummondii* (Aud. & Bach). This widely distributed rodent ranges over practically the whole of Saskatchewan, in typical form, except in the extreme southwest. Approaching the Missouri watershed the animals become increasingly subtypical in the attenuated blending with *M. p. inspreatus*. Diversification of habitat is remarkable, extending, as it does, from the semiarid plains, at one extreme, to high latitudes in the boreal forest at the other.

At times *drummondii* is regionally or locally abundant, or conversely, scarce. In south-central and northern areas it was fairly common in 1942 and 1943; locally abundant in 1944; and apparently scarce everywhere in 1946. Over the years, average rate of capture was 4.3 per 100 trap-nights,

with extremes of .7 and 24.1, respectively. A series of 33 adults and subadults from McDonald Lake, Glen Ewen, Red Fox and Last Mountain lakes, Chaplin, Carlton and Prince Albert Park have average measurements of 149.4, 40.2, 19.1 (131, 30, 18—170, 52, 21) mm; mean weight of 12 examples: 35.3 (23.9—49.4) grams.

BADLANDS MEADOW VOLE *Microtus pennsylvanicus insperatus* (Allen). Mostly confined to the semiarid lands of the Missouri watershed on the third prairie steppe. Chiefly inhabits grassy depressions and dry slopes, benchlands and ravines under cover of sparse grasses and low thickets of sagebrush, wild rose and juniper; in Cypress Hills it frequents moist streamside areas and grassy woodland glades. Usually, it was either rather scarce or only moderately common. However, it was found abundant at Battle Creek and Cypress Lake, in 1942, with the high capture rate of 44 per 100 trapnights. Most individuals display more or less intergradation with *drummondii* (Soper, 1946).

Twenty-five adult Saskatchewan specimens have average measurements of 157.3, 42.4, 20.2 (130, 36, 19—175, 53, 21) mm; mean weight of 10 individuals: 39.2 (31.1—53.0) grams. Specimens were taken at Battle and Middle creeks; Cypress and Fife lakes; Frenchman River (near Ravenscrag, Eastend, and international boundary); Rocky Creek; and Big Muddy Lake. There are also three specimens in the National Museum of Canada from Crane Lake.

Two females taken at Battle Creek on June 21, 1942, each contained six embryos with a mean length of 12 mm. Specimens from Big Muddy Lake are chiefly intergrades, but it seems best to include them under the present form. The population east of there, on the second prairie steppe, is clearly referable to *drummondii*.

LITTLE UPLAND VOLE *Pedomys ochrogaster minor* (Merriam). Locally inhabits the Transition parklands, on all three prairie steppes, from Manitoba to Alberta. A few also occur on the highlands of the Missouri Coteau as far west as Big Muddy Lake. Within this range, its occurrence seems to be extremely capricious in relation to time, place and relative abundance. Failures in trapping are more common than successes. My experience points to more consistent tenancy and larger populations in the extreme southeast, these qualities gradually diminishing to the north and northwest.

Only in the following localities was this vole personally captured: Big Muddy and McDonald lakes, Glen Ewen and Broadview; average measurements of 23 examples: 126.8, 31.8, 16.9 (113, 22, 15.5—150, 40, 17) mm; mean weight 23.5 (20.4—30.3) grams.

PALLID SAGEBRUSH VOLE *Lagurus curtatus pallidus* (Merriam). For many years the Canadian occurrence of *pallidus* was entirely hypothetical. Finally, I had the pleasure of securing the first museum specimens at Lodge Creek, Alberta, on August 5, 1927, and establishing the first Saskatchewan record ten days later at Battle Creek. As a detailed account of the sagebrush vole in Canada was written earlier (Soper, 1931), remarks here will be brief. Since that time some additional information has been gathered.

With a few exceptions, *pallidus* is restricted to the high, semiarid plains drained by the Missouri River and its tributaries. In that territory it was collected at Battle and Middle creeks; Cypress Lake; 8 miles southeast of Pallisade; Frenchman River (near Ravenscrag, Eastend, Val Marie, "Prairie Dog Buttes," and the international boundary); Rocky Creek; and Fife and Big Muddy lakes. North of the divide *pallidus* was taken at Duncairn Reservoir (Swift Current Creek) and Tenaille Lake, north of Maple Creek.

A series of 53 specimens from the above locations average 126.7, 20.3, 17.5 (110, 22, 15—138, 21, 18) mm; mean weight of 14 adults and subadults: 33.6 (21.6—49.1) grams. Two gravid females taken on June 14 and 18, 1942, had the following features: weight, 49.1 grams, 8 fetuses averaging 18 mm. in length; weight, 48.5 grams, 6 fetuses averaging 22 mm long. Six juveniles collected at the same time averaged 95.2, 17.6, 15.5 mm and had a mean weight of 13.7 grams.

HUDSON BAY MUSKRAT *Ondatra zibethicus albus* (Sabine). A more or less common inhabitant of sloughs, lakes and streams in south-central and eastern Saskatchewan, chiefly in boreal forest on the Hudson Bay watershed. Presumably it meets the range of *O. z. spatulatus* somehwere in the northwestern part of the province. The type locality is Cumberland House. There is a dearth of specimens, but the animals have been observed in many localities within its known, or postulated range. A male collected at Crean Lake, Prince Albert Park, measured 555, 264, 70 mm, and weighed 2.12 lb.

GREAT PLAINS MUSKRAT *Ondatra zibethicus cinnamominus* (Holister). A paler form of the arid and semiarid plains and more northern prairies. Over most of its Canadian range it undergoes variable stages of integration with *albus* in or near the aspen grove belt. Most of the typical population resides on the third prairie steppe, but specimens assigned to *cinnamominus* also derive from the second steppe east of the Missouri Coteau. In all, 18 adult and subadult specimens were collected at Battle Creek, Eastend, Val Marie, Rocky Creek, Fife Lake, Glen Ewen and Thunder Creek, near Chaplin; average measurements of these are 504, 218, 74 (460, 215, 70—570, 245, 75) mm; mean weight: 1.8 (1.25—2.25) lb. Individuals (presumably *cinnamominus*) were also sighted at Cypress Lake, Swift Current and Maple creeks, Red Fox and Dead lakes, and Moose Mountain.

HUDSON BAY JUMPING MOUSE *Zapus hudsonius hudsonius* (Zimmermann). A distinctly boreal race with wide distribution in mixed-wood forest of the Canadian Zone. *Hudsonius* was personally taken only in Prince Albert Park (1940-1946) where it was scarce and erratically distributed. Only 12 were captured in approximately 1,975 trap-nights. These derived from Sugar Creek and Amyot, Namekus and Crean lakes; average measurements: 213, 129, 30.3 (205, 119, 29—224, 133, 31) mm; mean weight: 16.9 (14.7—19.3) grams.

(Note: According to Krutzsch (1954) *Zapus h. campestris* does not occur in southeastern Saskatchewan as formerly listed; there is some possibility, however, that the race *Z. h. intermedius* may range into the southeastern extremity of the province.)

SASKATCHEWAN JUMPING MOUSE *Zapus princeps minor* Preble. This is the common jumping mouse of the Great Plains west of the Missouri Coteau. The peak of more or less consistent, local distribution and occurrence is reached on the semiarid plains of the southwest. Frequency of occurrence diminishes to the north. Extent of range in that direction is poorly known, but it occurs to at least latitude 53°, and on the west side of the province to perhaps 54° 20′ N, as in Alberta.

Eight specimens from Battle Creek, Cypress Lake, Rocky Creek, Big Muddy Coulee and Broadview have the following average measurements: 218.2, 129.3, 29.9 (205, 124, 28—228, 135, 31.5) mm; weights of two examples: 21.1 and 23.1 grams. Jumping mice (undoubtedly *minor*) were also reliably reported as occurring at Dollard; Frenchman River, to the south; and Duncairn Reservoir, Swift Current Creek. Type locality is Wingard, near old Carlton House.

EASTERN CANADA PORCUPINE *Erethizon dorsatum dorsatum* (Linnaeus). Nearly all the coniferous forest of northern Saskatchewan falls within the range of this subspecies. Apparently intergradation takes place with *E. d. myops* in the extreme northwestern part of the province. According to personal investigation, porcupines are extremely scarce, or absent, in numerous southern Canadian Zone localities. Records appear to be few and far between. There is a very fair representation, however, in most areas of Prince Albert National Park.

NEBRASKA YELLOW-HAIRED PORCUPINE *Erethizon dorsatum bruneri* Swenk. *Bruneri* is only barely represented in Canada north of the international boundary. Here, its range appears to be restricted to the Missouri watershed from about Big Muddy Lake west, possibly, to lower Frenchman River below Val Marie, or Eastend. Identity of porcupines in southeastern Saskatchewan and southwestern Manitoba has evidently not been satisfactorily determined to date. Two specimens collected at Rocky Creek (well south of Wood Mountain) are regarded by Anderson (1946: 173) as intergrades, but nearer to *bruneri* than either *dorsatum* or *epixanthum*. These were taken on September 11-12, 1927; measurements and weights are as follows: male, 680, 200, 105 mm, 17 lb; female, 690, 230, 95 mm, 16 lb. At that time the animals were fairly common in brushy stream valleys and tributary coulees. Occasional examples were also noted from Fife Lake west to Frenchman River below 'Prairie Dog Buttes.' Ranchers stated that a few roamed the brushy gulches of the Waniska Coulee badlands and wooded ravines along the south side of Big Muddy Valley.

CALIFORNIA PORCUPINE *Erethizon dorsatum epixanthum* Brandt. As an intergrade with *bruneri*, this form occupies the Cypress Hills district of Saskatchewan and Alberta and occurs west in at least the Milk River drainage. I collected no specimens in the Saskatchewan part of the range, but have reliable records of occurrence at Middle and Battle creeks and around the headwaters of Frenchman River east to Ravenscrag and Eastend. Two adult females collected just over the Alberta border, at Lodge Creek, measured 765, 205, 100 and 790, 220, 120 mm, and

weighed 23 and 25 pounds, respectively. A juvenile female taken there on August 2, 1927, measured 530, 140, 80 mm and weighed 8 lb.

PLAINS COYOTE *Canis latrans latrans* Say. More or less commonly distributed over most of the territory under review. It appears to be equally adapted to highly differentiated environments from the semiarid plains of the south, through the parklands and into the mixed-wood forest to meet the range of *C. l. thamnos* to the north and northeast. Through the years, coyotes were observed in a multitude of localities where they vary in numbers from time to time. For the most part, despite control measures, the shrewdness and fecundity of the animals appear to defy man's efforts at little more than token and temporary reductions in the population.

NORTHEASTERN COYOTE *Canis latrans thamnos* Jackson. Occurs in the east-central part of the area under review, south to about latitude 51° N. Its range is chiefly within the Canadian Zone; a fairly common denizen of the northern wilderness where it is familiarly known as the brush wolf.

SASKATCHEWAN TIMBER WOLF *Canis lupus griseoalbus* Baird. An inhabitant of the vast, unsettled reaches of the northern mixed-wood forest where it is still moderately common. Type locality: Cumberland House, Saskatchewan River. In earlier times wolves ranged south to about the latitude of Carlton. With expanding settlement, however, they have been pushed back farther to the north, but rare strays still reach the upper parklands.

At the present time real wolf country begins in approximately the latitude of Montreal and Cold lakes. In the thirties and forties wolves were well represented in Prince Albert Park, especially in the northern areas. The species began increasing in numbers throughout the north about 1925. In the park this expansion was first well marked by the late thirties and by 1941 the animals had become common; this trend continued until at least 1948.

NORTHERN PLAINS RED FOX *Vulpes fulva regalis* Merriam. Generally, but sparingly distributed in the parklands, becoming more numerous in the Canadian Zone to the north. I did not detect the red fox anywhere in the shortgrass plains region of the southwest, but it has been reported in Cypress Hills. Marked numerical fluctuations occur from time to time; the animals were notably plentiful in 1942-43. A male collected at Harper Lake on November 29, 1927, measured 1123, 459, 216 mm; at that time and place red foxes were rather scarce.

PRAIRIE KIT FOX *Vulpes velox hebes* Merriam. Formerly inhabited the dry plains of the southwest in considerable numbers, but is now either exceedingly rare, or more probably extinct. Mr. George Ecker, who homesteaded near Swift Current Creek (west of Vesper) saw the last one detected in that district during the autumn of 1910. By 1927 it was nearly exterminated farther south; evidently only a very few widely scattered individuals still existed in the Altewan district; in scattered badlands south of Frenchman River; and in wilder sections east to about Wood Mountain. In later years, farmers and ranchers alike were of the opinion that the species had been totally wiped out on its former Saskatchewan range.

BLACK BEAR *Euarctos americanus americanus* Pallas. Occurs province-wide, in varying abundance, throughout most of the northern mixed-wood forest. As compared with earlier times, it has been greatly reduced in numbers, or locally exterminated, all along the pioneer fringe. The species is common in Prince Albert Park and reported as generally well represented elsewhere in the Canadian Zone of similar and higher latitudes.

UPPER MISSISSIPPI VALLEY RACCOON *Procyon lotor hirtus* Nelson & Goldman. Apparently rare and mostly confined to the southeastern portion of the province. I was never able to collect a specimen in Saskatchewan, but in May 1946, raccoon tracks were seen on a mud spit along Souris River below Dead Lake. In earlier years, farmers had asserted that several of the animals had been shot along the latter stream and at Long Creek. Rare strays occur north to Moose Mountain and northwest in the parklands.

HUDSON BAY MARTEN *Martes americana abieticola* (Preble). Type locality: Cumberland House. Formerly common in the evergreen forests of the Canadian Zone (already declining by 1820), but was becoming very scarce in most of the lower fringe of the coniferous forest by the early part of the present century. In 1927 only rare individuals still existed in the territory from Birchbark and Harper lakes northwest to Prince Albert Park and Primrose Lake. During intermittent personal investigations in the park from 1940 to 1946, the species appeared to be either extremely rare or nonexistent. Similar conditions undoubtedly prevailed in adjacent and more distant territory.

BRITISH COLUMBIA FISHER *Martes pennanti columbiana* Goldman. Provincial range and status of this species is substantially similar to that of the marten. In some areas it is evidently even scarcer. For a long time it has not been common anywhere. In 1927 rare stragglers still occurred in primitive forest near Harper Lake and in Prince Albert Park. In the latter area it was not recorded for many years. Accordingly, it was considered to be locally extinct, but in the winter of 1945-46 Warden Harrison came upon a fisher trail between Crean and Tabiska lakes.

RICHARDSON WEASEL *Mustela erminea richardsonii* Bonaparte. A common species with wide dispersal in the Canadian Zone, and Transition parklands to the south. Evidence of occurrence was gathered in numerous localities from Moose Mountain, in the southeast, northwest to the vicinity of Cold Lake. Large numbers are harvested by professional trappers and farm boys over the region at large. Four specimens collected at Harper Lake and Prince Albert Park average 304, 94.5, 38.4 (248, 86, 31—342, 106, 41.5) mm.

LEAST WEASEL *Mustela rixosa rixosa* (Bangs). The known range of this little carnivore covers the whole province from the international boundary to the Hudsonian Zone. Osler is the type locality. Some trappers refer to it as the kit weasel. On the whole it is rare, or comparatively rare, but in some exceptional instances it has been found more numerous locally than over the region at large. Thus, in 1939, Miss Doris Scott of Roscoe reported that about a dozen least weasels had been trapped in that locality over a span of a few years. The only specimen secured by me in Saskatchewan was a male taken at Eastend on August 30, 1927, measuring 153, 19, 21 mm.

PRAIRIE LONG-TAILED WEASEL *Mustela frenata longicauda* Bonaparte. Type locality: Carlton House. General distribution embraces the entire southern part of the province north to the fringelands of the Transition-Canadian zones. Within this region, however, there seems to be considerable variation in local numbers. The animals occasionally, if not habitually, wander well into the woods flanking the open prairies and a few also penetrate the northern mixedwood forest to some extent. Individuals were noted in many localities where specimens were not obtained, since they often boldly hunt for prey during the day. Only two specimens were collected: Val Marie, July 7, 1937, male, 448, 165, 51 mm; and Highfield Reservoir, July 18, 1946, female, 390, 138, 46 mm, 293.5 grams.

HUDSON BAY MINK *Mustela vison lacustris* (Preble). The mink is a typical inhabitant of the boreal forest, where maximum numbers prevail. Limited numbers also frequent streams in the upper reaches of the Transition Zone. I obtained no information as to occurrence anywhere on the southern short-grass plains, west of Big Muddy Lake, except at Cypress Hills; here a few were reported as existing at Elkwater Lake and around the headwaters of Battle and Swift Current creeks and Frenchman River. Local ranchers stated that in the early days of settlement mink were fairly common all along Swift Current Creek to, and including, South Saskatchewan River. Owing to inroads of settlement, the species has dwindled greatly, or totally disappeared, in many of its former haunts. A few years ago it was abundant in some northern tracts of Prince Albert Park.

BLACK-FOOTED FERRET *Mustela nigripes* (Aud. & Bach.). Ranges sparingly on the semiarid plains of the third prairie steppe (west of Missouri Coteau) up to a maximum distance of about 120 miles from the Montana border, but most occurrences are relatively close to the latter line. There are now about two dozen authentic records for southwestern Saskatchewan. Collectively, most of the related information is contained in the puplications of Soper (1946) and Anderson (1946: 68).

AMERICAN BADGER *Taxidea taxus taxus* (Schreber). In 1927 badgers were fairly abundant over a wide area in southwestern Saskatchewan; likewise, in the more northern prairies and parklands in earlier times. Since then they have been greatly reduced in numbers, or even locally exterminated. Despite great additional coverage of Saskatchewan territory between 1935 and 1948, only a relatively small number if animals, or their signs, were observed. In the forties a few were known to have wandered as far north as the grasslands in the southern section of Prince Albert Park, which is apparently the most northern record.

NORTHERN PLAINS SKUNK *Mephitis mephitis hudsonica* Richardson. Generally dispersed in nearly all types of environment, occurrence is somewhat spotty, however, while relative abundance varies considerably with zonal conditions. Thus, it appears to be most numerous in the parklands and lower lati-

tudes of the Canadian Zone and least so in the semiarid lands of the Missouri watershed. Field notes list its presence in numerous localities over the whole width of the province and, in extremes of habitat, from the dilute Upper Sonoran sagebrush plains north to Prince Albert Park. In the latter territory and other central areas the species was common. Carlton House is probably the type locality.

MACKENZIE OTTER *Lutra canadensis preblei* Goldman. At present undoubtedly scarce, or rare, throughout its natural haunts in the Canadian Zone. In primitive times the otter was not uncommon in a deep fringe area immediately north of the parklands, where it is now practically unknown. In most of this territory it is gone beyond recall. A few pairs still inhabit the wilder and more remote sections of Prince Albert Park.

NORTHERN COUGAR *Felis concolor missoulensis* Goldman. There have been several unconfirmed reports of cougars seen, or shot, in southern Saskatchewan. Most of these were in the early part of the century. In any event, occurrences were rare and are becoming rarer. A reliable record implicates one that was killed about 1912 near old Fort Walsh, Cypress Hills (Soper, 1946). On August 18, 1939, another was shot on a farm a few miles south of Kindersley (Can. Field Nat. 56:45, 1942).

CANADA LYNX *Lynx canadensis canadensis* Kerr. In various degrees of abundance presently confined chiefly to the heavily timbered recesses of the Canadian Zone. In earlier times the species consistently ranged throughout the lower extremity of the boreal forest, as well as to some extent into the adjoining parklands. It is now scarce, extremely rare, or entirely wanting in those parts (Harper Lake, Prince Albert Park, Cold Lake, etc.)—a condition that has prevailed there for the past 30 to 40 years. Of considerable interest is the fact that until the early thirties, at least, a few lynx still survived in the isolated 'island' of heavy Canadian Zone forest on Cypress Hills.

PALLID BARRED BOBCAT *Lynx rufus pallescens* Merriam. A rare straggler into southwestern Saskatchewan and adjacent Alberta. It was learned reliably, in 1927, that an occasional bobcat resorted to Cypress Hills. During further field work over that general territory in 1937, 1942 and 1946, nothing more was ascertained regarding its presence north of the international boundary.

MANITOBA WAPITI *Cervus canadensis manitobensis* Millais. Occurs, or did occur, in the upper reaches of the east-central parklands (and adjoining parts of Manitoba) and northward into the lower tracts of the Canadian Zone. It is now absent in various districts formerly inhabited. In the early winter of 1927 I collected three specimens at Harper Lake for the National Museum of Canada; these measured: male, 2065, 162, 633; female, 2346, 162, 664; and female, 2322, 160, 662 mm. At that time wapiti were plentiful and well distributed in the region. Of recent years it has been the most plentiful of big game animals in Prince Albert Park. In 1942 a few were said to still roam the wilder parts of Moose Mountain.

ROCKY MOUNTAIN MULE DEER *Odocoileus hemionus hemionus* (Rafinesque). The overall range of these deer embraces practically the entire territory under review. In certain areas they are common, in others scattered. It was personally observed in a multitude of localities from the international boundary north to Prince Albert Park and in other areas to the east and west. In many places on the treeless plains it is absent, of course, owing to lack of cover; however, it occurs in various wooded or brushy valleys that intersect this type of terrain. Two mule deer that I collected at Harper Lake, mid-November, 1927, measured as follows: female, 1734, 230, 535 and female, 1785, 230, 561 mm. In recent years *hemionus* has been gradually extending its range into more northern latitudes.

DAKOTA WHITE-TAILED DEER *Odocoileus virginianus dacotensis* Goldman & Kellogg. Provincial distribution of the whitetail is very similar to that of the mule deer. In some parts of the high southern plains it seems to be the more numerous of the two species, but in the northern parklands and lower Canadian Zone the status is reversed. Moreover, *hemionus* ranges much farther north, at least on the western side of the province and in Alberta. Within the memory of early settlers, the present species has become much more common in some southern areas of the province; also, to a considerable degree, it has supplanted the earlier-established mule deer.

Dacotensis was personally observed at Battle and Middle creeks; Cypress Hills; Wood Mountain; Oxbow; Moose Mountain; Ponass, Basin and Lenore lakes; Hudson Bay Junction, and Prince Albert Park. Evidently

it first appeared in the latter district sometime in the thirties, subsequently showing a moderate increase in numbers. In 1943 one was seen as far north as Crean Lake.

NORTHWESTERN MOOSE *Alces alces andersoni* Peterson. Normally, a habitué of the dark and secluded boreal forest, but it occasionally appears in the contiguous fringes of the parklands. It is quick to retreat before the advances of settlement. Distribution embraces all, or most, of Saskatchewan's coniferous forest (see Peterson, 1952). In 1942 it was reported as still occurring on Moose Mountain—a southeastern highland completely surrounded by parklands. In 1927 I collected two moose in Saskatchewan as follows: Harper Lake, Nov. 23, female, 2371, 153, 765 mm; Birchbark Lake, Dec. 14, male, 2525, 153, 841 mm. In some areas, such as in Prince Albert Park, moose are common; there they have been protected since 1927.

WESTERN WOODLAND CARIBOU *Rangifer caribou sylvestris* (Richardson). Uninhabited boreal forest is the home of the caribou. It is characterized by irregularity in distribution and local abundance. Throughout the southern part of its primordial range *sylvestris* has partially, or totally disappeared. Owing to pronounced sensitivity — the shunning of man and his works—the species has generally withdrawn to higher latitudes. In 1919 the animals were sparingly represented in the Cold and Primrose lakes area and, in 1927, a few still visited Harper Lake during the winter and early spring.

Within recent years a few caribou have been reported in the wilds of Pasquia Hills—currently the southernmost point of residence in Saskatchewan. Moderate-sized herds were also known to occur north of Cumberland Lake and in various other districts, within the Churchill drainage, such as at Lac la Ronge and Dore, Ile à la Crosse and Peter Pond lakes. Until the forties, at least, a few dozen still wandered into northern Prince Albert Park for the winter months, most of which then withdrew in early spring to more northern areas; scattered individuals, however, remained for the summer in remote tracts north of Crean and Kingsmere lakes. At present, from spring until early winter, it appears probable that very few caribou are to be found south of about latitude 55°N.

PRONG-HORNED ANTELOPE *Antilocapra americana americana* (Ord). In primitive times and until about 1881, the pronghorn roamed over an immense Great Plains territory from southwestern Manitoba nearly to the Rockies and north to the vicinity of North Saskatchewan River. Occupied range has since become drastically reduced; it now covers little more than extreme southwestern Saskatchewan and southeastern Alberta. By the early twenties only a few hundred remained in that area. Rigid protection then produced amazing results; two decades later the population had risen to well over 30,000 head. Since that time a limited fall hunt has been authorized.

Saskatchewan herds and individuals are distributed locally in varying abundance from about Big Muddy Lake to Cypress Hills and in lesser numbers northward to about South Saskatchewan River. In some localities they are common. Maximum numbers appear to exist south of Cypress Hills and irregularly eastward in country drained by Frenchman River; some group concentrations also center about Morgan and Rocky creeks south of Wood Mountain. Two males collected at Lodge Creek, in 1927, measured, respectively: 1380, 80, 425 and 480, 110, 405 mm.

PLAINS BISON *Bison bison bison* (Linnaeus). Formerly occurred in prodigious numbers over the shortgrass plains, prairies and parklands of southern Saskatchewan; limited numbers also frequented lower fringe areas of the boreal forest. Where it intergraded with the wood bison, *B. b. athabascae*, in the latter environment, is now only a matter of conjecture. In this province scattered remnants of the wild herds were finally exterminated between 1875 and 1883. A few are preserved in an enclosure near the southeastern corner of Prince Albert National Park.

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OBSERVATIONS ON INFECTION OF WHITE GRUBS, *PHYLLOPHAGA* SPP., BY *CORDYCEPS RAVENELLII* BERK. & CURT. IN EASTERN CANADA

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REFERENCES to fungi parasitic on white grubs in Eastern Canada are few. Fletcher (1898) reported one species of *Cordyceps* as an effective control. In 1903 he reported the collection of *C. melolonthae* (Tul.) Sacc. from Ottawa and Renfrew, Ontario. Fyles (1912) reported remarkable larval control from *C. melolonthae*. Davis (1919) doubted the economic value of control by parasitic fungi in cultivated areas. Both Overholtz (1938) and Mains (1939, 1940) pointed out that *Cordyceps* spp. were common in many insects in eastern North America but that *C. ravenellii* Berk. & Curt. attacked only larvae of *Phyllophaga* spp.

The following notes are based on observations made since 1928. In Quebec, *Cordyceps*-infected grubs were collected at Montreal (1928), Hemmingford and Roxton (1929), and Clarenceville (1929, 1935, 1940); in Ontario, at Ottawa (1931), Apple Hill and Monkland (1934), Marmora (1945), and Cordova (1937). The degree of infection varied greatly. In 1929, at Hemmingford, only one infected grub was found in 1199 second-year larvae examined, whereas at Marmora, in 1945, 1110 infected grubs occurred in a total of 4036, or 27.5 per cent. At Clarenceville in 1929, 118 infected grubs were found in 198 examined. Since 1945 only occasional grubs infected by *Cordyceps* have been found in Ontario.

Cordyceps-infected grubs were usually found in grub concentrations where the sod was detached previously through white grub feeding. In September and later, infected grubs, always in the third instar, were found scattered irregularly among healthy grubs. Their dull-brown color contrasted sharply with the glistening white color of healthy grubs. The infected specimens were considerably shrunken, dry but elastic; all internal organs were gone and the body cavity was filled with the light-colored mycelium of *Cordyceps*.

Later it was found that healthy grubs moved into the subsoil while the parasitic fungus in diseased specimens continued development until the freeze-up. External growth of the fungus was evident as stromata which arose from the head-protheracic suture; these grew vertically and increased to a maximum length of half an inch for that year. With early spring, growth continued vertically until the stromata were several inches above the soil level. About midsummer, enlargement of the apical area indicated the development of ascospores. Whether the ascospores cause re-infection directly was not determined. The fungus evidently lives in the grub body for some time but is not fatal until late in the second year, when larval feeding is largely over and the grub has reached the mature third-instar form.

In 1940 mature larvae of *P. anxia* Lec., with stromata 4-6 inches long, were taken from the field and placed in dry vials at the Marmora laboratory. Later these specimens produced ascospores that were identified as *Cordyceps ravenellii* Berk. & Curt. by Dr. A. B. Mains of the University of Michigan. The specimens are preserved in the mycology collection (Herbarium No. DAOM-51911) of the Plant Research Institute, Research Branch, Canada Department of Agriculture, Ottawa, Ontario.

Whether *Cordyceps* fungus can be artificially propagated with success remains to be determined. It is found much more commonly in untilled soil. It is also not known whether *C. ravenellii* normally infects species of *Phyllophaga* other than *P. anxia* Lec. and *P. fusca* Froel.

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STATEMENT OF FINANCIAL STANDING
THE OTTAWA FIELD-NATURALISTS' CLUB, NOVEMBER 29, 1960

CURRENT ACCOUNT

Assets		Liabilities	
Balance in bank, Nov. 29, 1960	$1,363.08	Checks outstanding	$ 33.40
Bills receivable, separates	77.25	Balance	1,406.93
	$1,440.33		$1,440.33
Receipts		**Expenditures**	
Balance in bank, Nov. 30, 1959	671.19	Can. Field Nat., 4 numbers	2,816.00
Cash on hand, Nov. 30, 1959	93.22	Separates and illustrations	667.55
Fees:		Editor's honorarium	100.00
Current $2,246.97		Business manager's honorarium	15.00
Advance 377.27		Newsletter	97.24
Arrears 182.30		Excursions and Lectures Comm.	
Associate 64.00		Annual Dinner $ 163.00	
	2,870.54	FON Regional Gathering 215.00	
Separates and illustrations	1,081.19	Operations 45.64	
Sale of back numbers	410.94		423.64
Excursions and Lecture Committee returns	419.90	Macoun Club buses	65.00
Bartman lecture	360.25	Postage and Stationery	230.40
Donations:		Bartman lecture	137.60
Affiliated Societies 70.00		Bank Discount	23.70
Private 25.00		Foreign exchange	42.71
	95.00	Miscellaneous	69.16
Miscellaneous	15.45	Bank Balance Nov. 29, 1960	
		1,363.08 less 33.40 o/s checks	1,329.68
	$6,017.68		$6,017.68

RESERVE FUND

Assets		Liabilities	
$3,000 Ontario Hydro 3% bonds, market value	$2,580.00		
15 shares Bell Telephone stock, market value	701.25	NIL	
Balance in bank, Nov. 29, 1960	229.86		
	$3,511.11		
Receipts		**Expenditures**	
Balance in bank, Nov. 30, 1959	$ 109.98		
Bank interest	1.88	Safety deposit box rent	5.00
Bond interest	90.00		
Dividends Bell Telephone	33.00	Balance in bank, Nov. 29, 1960	229.86
	$ 234.86		$ 234.86

PUBLICATIONS FUND

Assets		Liabilities	
$1,500 Ontario Hydro 3% Bonds.. market value	$1,290.00		
Balance in bank, Nov. 29, 1960	141.75	NIL	
	$1,431.75		
Receipts		**Expenditures**	
Balance in bank, Nov. 30, 1959	$ 95.21		
Bank interest	1.54		
Bond interest	45.00	Balance in bank, Nov. 29, 1960	141.75
	$ 141.75		$ 141.75

Audited and found correct.
(Signed) I. L. Conners
C. Frankton, Auditors

(Signed) J. M. Gillett, Treasurer

REPORT OF COUNCIL, THE EIGHTY-SECOND ANNUAL MEETING OF THE OTTAWA FIELD-NATURALISTS' CLUB, DECEMBER 1, 1960

Since the last annual meeting there have been five council meetings at the National Museum of Canada: December 17, 1959, February 25, May 5, September 15, and November 3, 1960, with an average attendance of 15 council members. The council has conducted the club's business in an orderly manner throughout the year.

Appointments for 1961 offices were made as follows:

Editor, CANADIAN FIELD-NATURALIST — R. A. Hamilton
Business Manager, CANADIAN FIELD-NATURALIST — W. J. Cody
Chairman, Publications Committee — W. J. Groves
Chairman, Excursions and Lectures Committee — D. R. Beckett
Chairman, Reserve Fund Committee — Hoyes Lloyd
Chairman, Bird Census Committee — V. E. F. Solman
Chairman, Macoun Field Club Committee — H. J. Scoggan
Chairman, F. O. N. Affairs Committee — W. K. W. Baldwin
Representatives, Canadian Section, International Committee for Bird Preservation — W. E. Godfrey, D. A. Munro
Representatives, Citizens Committee on Preservation of Historic Sites — W. K. W. Baldwin, W. Dore, D. R. Smith and V. E. F. Solman.

The club learned with regret of the passing of two of its older supporters during 1960: Mr. D. C. Maddox and Mr. E. F. G. White (former President).

REPORT OF THE PUBLICATIONS COMMITTEE

During 1960 four numbers of Volume 74 of the Canadian Field-Naturalist have been published comprising a total of 182 pages plus index. Papers, notes, and reviews were distributed as follows:

	Papers	*Notes*	*Reviews*
Botany	3		8
Entomology	2	1	1
Geology		1	1
Herpetology	1		3
Ichthyology		2	3
Mammalogy	5		
Ornithology	6	11	3
Miscellaneous	1		12
	18	15	31

Accounts totaling $3,530.90 for Vol. 73, No. 4, and Vol. 74, No. 1-3 have been approved by the committee. Of this total, $495.29 was for reprints and will be recovered from the authors. In addition $325 was received from some institutions with which authors were associated to cover the cost of extra pages. Contributions totaling $70 were received from five of our affiliated societies to help defray the rising costs of publication of the Canadian Field-Naturalist. To date a total of $375.44 has been received from the sale of back numbers.

REPORT OF THE RESERVE FUND COMMITTEE

No business was placed before the Committee in 1960.

REPORT OF THE MEMBERSHIP COMMITTEE

An advertisement soliciting new members was published on the back cover of the Canadian Field-Naturalist throughout the year. It was hoped that this might attract new members from library readers. It is not known if any new members were so obtained. No expense was incurred.

REPORT OF THE BIRD CENSUS COMMITTEE

The 1959 Christmas Bird Census was held on December 27. A total of 45 species were observed by 41 observers. The censuses for all of Canada were published in the Canadian Field-Naturalist, Vol. 74, No. 1.

REPORT OF THE MACOUN FIELD CLUB COMMITTEE

Enrolment in the Club now stands at eighty-six, with thirty juniors, twenty-nine intermediates and twenty-seven seniors. Cedric Pearson, Mark Blackburn and Gary Kaiser are the new presidents of the junior, intermediate and senior groups, respectively. Six field trips were held, three in the spring and three in the fall. The regular weekly indoor meetings featured fifteen visiting speakers.

REPORT OF F. O. N. AFFAIRS COMMITTEE

The committee continued liaison with the Federation of Ontario Naturalists headquarters in Toronto. A highly successful Eastern Ontario regional gathering was conducted in Ottawa on October 7 and 8. About 65 took part in the field trip on Saturday, which centered on the theme: geology of the Ottawa district based upon Dr. Alice Wilson's guide. There were also evening films and a smorgasbord in the National Museum.

The committee also sponsored the visit and special lecture of Mr. Marshall Bartman on March 24, 1960. Two committee members have contributed to the forthcoming F. O. N. Naturalists' Guide to Ontario.

A. W. F. Banfield, *Secretary*

TRANSLATIONS FROM THE RUSSIAN

The seventh volume in the series "Translations of Russian Game Reports" is announced by the Canadian Wildlife Service. It contains selections from "Acclimatization of Muskrats in the U.S.S.R.," by N. P. Lavrov, and is sold by the Queen's Printer, Ottawa, Ontario, for $1.00. A cheque or money order should be made payable to the Receiver General of Canada.

The new Canadian Amphibian and Reptile Conservation Society is devoted to furthering the protection of and knowledge about amphibians and reptiles, and to providing a means for those interested in the subject to meet and exchange ideas. Mr. E. B. S. Logier is the president. The secrtary is Mr. Alex Findlay, 27 Letchworth Crescent, Downsview, Ontario.

REVIEWS

Most reviewers may be identified on the inside front cover of this issue. The affiliation or address of other reviewers follows the author's name.

The Kirtland's Warbler

By HAROLD MAYFIELD. Bloomfield Hills, Michigan, Cranbrook Institute of Science, 1960. 242 p. $6.00.

Although detailed accounts of a number of birds are now available, Mr. Mayfield's study is distinctive particularly because Kirtland's Warbler is most unusual among strongly migratory birds in its severely restricted breeding range. The limited range and habitat have, in fact, made the Kirtland's or Jack-pine Warbler famous. The late Josselyn Van Tyne hoped to write a comprehensive study of this species, which he studied for so long; and Mayfield is to be congratulated on working up the data. Although he had participated in much of the field work, most of the information had to be culled from Van Tyne's cryptic files and field notes. The chapter headings show the plan of the book: introduction, history, the nesting ground, wintering ground and migration, mating and territorial behavior, the nest, eggs, incubation, nestling period, fledglings, song, weights and plumages, the cowbird, reproduction and mortality, and problems for further study.

When jack pines grow nearly from coast to coast why should a species that inhabits them be restricted to a small area in the northern part of Michigan's Lower Peninsula? This is a relict pattern, which the biogeographer inevitably views with concern. Although Mayfield terms the position of the species precarious rather than critical, some will consider the latter term warranted, for there is no indication that the downward trend in the population has been halted. The species must have sandy soil, for otherwise the nests, in depressions on the ground, would be subject to flooding by rain. The bird accepts only pines about 5 to 15 feet high and associated with plenty of herbaceous ground cover. Such areas must be extensive, for the species is loosely colonial; single pairs seldom nest successfully. Small areas of pine scrub are thus unacceptable; the successful penetration of new areas is made difficult; and there is clearly danger of inevitable extinction through colonies falling below a critical minimum. Regrowth after extensive lightning fires seems to have provided the original habitat of this warbler. Today improved fire control means that most burns are small; and controlled cutting and planting on state lands seem to provide the best hope for its survival.

The greatest single menace to Kirtland's Warbler today is the Cowbird, to which the longest chapter in the book is devoted. Before the white man cleared much of the eastern forests, the Cowbird was a plains species that barely reached Ohio. Lumbering and farming allowed it to reach the breeding area of Kirtland's Warbler after 1870. It is significant that, in the wintering range in the Bahamas, 44 specimens were taken from 1880 to 1889, 22 from 1890 to 1899, and only three in the next 20 years. Since 1919 there has been no winter specimen and, despite repeated searches, only one acceptable sight record. It thus seems that a severe decline set in soon after the Cowbird reached the breeding area. Today, with the breeding population at scarcely 500 pairs, studies show that 55% of the nests are parasitized with the annual production of fledglings being reduced by about 40%.

The remoteness of the breeding area has limited the possible study time at the nests. Consequently some conclusions are inevitably based on limited data. Nevertheless the findings must provide

the basis for any possible action to save the species by extending or improving the breeding range, or by controlling the Cowbird through habitat manipulation or other means. There is no indication as yet that selection pressure has given the warbler any measure of defence against the Cowbird. Probably the concentrated population always possessed limited genetic diversity.

Readers may take issue with a few points, such as the late date for the start of the Wisconsin glaciation or the claim that the xerothermic came considerably later than the retreat of the Wisconsin ice; but in general the facts are strightforwardly presented and cautiously interpreted. The figures in the table on page 78 are nest numbers, not percentages, but I noticed no other mechanical errors. The publishers have achieved a most attractive format; the cover is graced by Peterson's painting of a family group, which also serves as a frontispiece.

D. B. O. SAVILE

Louis Agassiz, a Life in Science

By EDWARD LURIE. Chicago, University of Chicago Press, 1960. 449 p. $7.50.

This is a book that will interest everyone whether a trained scientist or not. Written in a pleasant readable style, it brings to life a man who made a tremendous impact on the science of his day and offers a critical yet sympathetic appraisal of his successes and failures.

Louis Agassiz was born in Switzerland in 1807 and studied at Munich under von Martius and at Paris under Cuvier. He was Professor of Natural History at Neuchatel from 1832 to 1846 when he came to North America on what was intended to be a temporary visit, but the next year he was appointed Professor of Geology and Zoology at Harvard where he remained until his death in 1873.

Here was a man of brilliant and powerful intellect, unbounded energy and enthusiasm, unquestioned dedication to natural history, and possessing a charming and magnetic personality, yet on reading this story of his life one is left with a tragic feeling of unrealized potentiality. The brilliance of his early work on fishes and on continental ice sheets won him recognition and renown among scientists and he came close to realizing his ambition of being recognized as the foremost naturalist of his day. However, the very fact of his great personal charm and ability to popularize science brought more and more involvement in what we would now term the public relations aspects of science. A disproportionate amount of his time was spent in public lectures, fund-raising campaigns, academic politics, and the accumulation of vast quantities of material that he never critically studied.

This led to immense prestige with the public but his reputation among his scientific colleagues declined and he lost touch with the current scientific advances and trends of thought. One of the most interesting parts of the book is the story of the evolution controversy in which Agassiz came out openly as an opponent of the theory of evolution without critically examining the evidence which, in the hands of his colleague Asa Gray, slowly and surely undermined his basic postulates.

Although Agassiz' scientific contributions did not fulfill his early promise, and the weight of his enormous prestige on the wrong side of the evolution controversy undoubtedly hindered the progress of biological research in North America, it must be remembered that he did accomplish a very great deal in making natural history intelligible to the public and in winning public support for naturalists, and some of his scientific research was of outstanding quality. This book is a rewarding study of a complex and fascinating personality.

J. WALTON GROVES

Australian Shells

By JOYCE ALLAN. Second ed. Boston, Branford, 1959. 487 p. $12.00.

This is undoubtedly the best popular guidebook to the shells of the Indo-Pacific region. It is comprehensive, well-written, and beautifully illustrated. Over two thousand species are discussed. Its general usefulness has been enhanced even further, in the second edition, by the inclusion of bibliographies and a complete index to scientific names.

Miss Allan's book contains eight major sections: (1) Introduction and General; (2) Sea Living Univalves; (3) Sea Slugs; (4) Chitons; (5) Tooth Shells; (6) Sea Living Bivalves; (7) Air Breathing Brackish Water Shells and Slugs, Land Snails and Slugs, and Freshwater Shells; and (8) Cephalopods. The first section is good reading and most instructive. In sections two through eight, with a few exceptions, families are discussed in standard systematic sequence.

The most serious criticism appears to be the overemphasis of 'common' names. Such names are used exclusively in the plate captions and are stressed throughout the book. Many of them were apparently coined by the author. In a popular work designed for a widespread audience, nothing is gained by manufacturing vernacular names or inserting little-used local terms to replace scientific names. Such titles as "Green Snail", "Northern Horse Mussel", "Razor Shell", "Jet Introduced Slug", and "Dumpling Squid" are entirely inadequate and sometimes misleading to shell collectors outside Australia. In addition, their overuse in this work causes the proper identification of a species to be much more involved than it should be.

Some additional criticisms could be offered but these are far over-balanced by the completeness, readability, and over-all value of the book. It is recommended without reservation.

ARTHUR H. CLARKE, JR.

Marine Infaunal Benthos in Arctic North America

By DEREK V. ELLIS. Montreal, Arctic Institute of North America, 1960. 53 p. Price: to members of the Institute, $1.00; to nonmembers, $2.00 (Tech. Pap. arctic Inst. N. Amer. 5).

This paper tells of one of the first attempts in the Canadian Arctic and west Greenland regions to measure the standing crop of marine infaunal animals, that is, those invertebrates living on or in the soft-bottom sediments. The standing crop, expressed as the amount of incinerated animal tissue per unit area of sea bottom, gives a measure of the quantity of food organisms available at any one time for possible utilization by economically important animals such as seals and certain fishes, and marine birds. It does not, however, give a measure of the *rate* at which the animals die and are replaced, a knowledge of which is vital to optimal exploitation of fisheries in the regions concerned.

Despite serious but unavoidable limitations in dredging methods, Ellis demonstrates what kinds of animals are most widely distributed, which are in densest concentration, and which are individually heaviest. From sampling data he selects dominant organisms and associated species that typify certain subtidal levels, depending on major factors such as bottom sediments, hydrographic conditions, and latitude. Despite comparable standing crops between arctic and warmer marine regions, the rate of infaunal production in the arctic is probably much less, owing to the long life of dominant arctic species, the small number of species reproducing by pelagic larvae, and the low weight of predators.

Although a little too technical for the lay reader and lightly sprinkled with minor mechanical flaws and unusual words, this paper ranks as a major contribution to our knowledge of arctic marine benthic animal communities. The

author's tabulated and appended list of species, fairly free of 'suspect' identifications but perhaps not sufficiently detailed for pertinent taxonomists, reveals his ready familiarity with the various invertebrate phyla. Although he has relied fairly heavily on the earlier work of Dunbar, McGinitie, and Thorson, among others, for several basic concepts, he is to be commended for the neat interpretation of the peculiar communities he encountered during his four-year exploration of the region, and for his good general grasp of problems relating to arctic marine ecology.

E. L. BOUSFIELD

The Balance of Nature

By LORUS J. MILNE AND MARGERY MILNE. New York, Knopf, 1960. 329 p. $5.50.

The last decades have brought an ever-increasing number of books emphasizing the need for conservation of the rapidly diminishing natural areas of the world and their inhabitants. Few authors have done better than the Milnes in presenting an eloquent chronicle of past and present deteriorative changes in the status of much of the world's flora and fauna.

A reader can't fail to be depressed when he is reminded of white man's folly in demanding a 100-percent yield from his land—something unknown in nature. Story after story recounts his greed for immediate economic gain to the detriment of the land and its wildlife, overshadowing any attempts at wise use of renewable natural resources. Most disturbing of all is the account of chemical warfare waged on insect and fungus pests which rapidly evolve resistant strains and continue their havoc. They record undeniable evidence that the indiscriminate use of untested 'pesticides' (really 'biocides') causes widespread death to the *natural* predators on insects, bringing about effects opposite to those desired.

Readers of the Milnes' earlier books and texts will be familiar with their clear, graphic and unfailingly interesting style and with their ability to incorporate well-chosen, often witty, and always pertinent quotations from other authors. They have drawn on their vast biological experience gained in field trips covering over 330,000 miles of travel and on an impressive acquaintance with the literature, both classical and up-to-date. A fine set of black and white illustrations by Olaus J. Murie, an unobtrusive but useful 23-page list of references and an index have been provided.

I noted only six typographical errors and can take exception to but a few minor points otherwise. To the American reader unfamiliar with Canada, the unqualified statement on page 77 that "in Canada . . . the timber wolf . . . may be scarcely reduced from pioneer times" may conjure up unrealistic visions of our country. The Ontario naturalist proud of the province's single species of lizard, the blue-tailed skink, will object to reading on page 119 that "Ontario has no lizards." The reader who is used to the common names of fishes in the works of Hubbs and Lagler and of Scott will find that on pages 151 and 152 the authors are confusing the commercially valuable lake 'herrings' or ciscoes (*Leucichthys* or *Coregonus*) with the alewife (*Pomolobus* or *Alosa*), which in the Great Lakes is "puny" and "unsaleable."

This sort of book, with its logical, nonhysterical, up-to-date documentation of facts *must* be widely read to arouse public opinion and action on local, national and international levels. Man must be educated *immediately* to understand the land and must be imbued with the obligation to leave it in better condition than he found it and to retain for future generations the long-term economic, cultural and esthetic values of its native flora and fauna.

DONALD A. SMITH

Fauna Japonica: Cottidae (Pisces)

By MASAO WATANABE. Published for the Biogeographical Society of Japan by Tokyo News Services Ltd., Ginza Nishi, Chuo-ku, Tokyo, 1960. 74 text figures, 40 plates, 218 p. $10.

This beautiful book, bound in cloth and leather and with clear plastic wrapper, is the first of a series on the fauna of Japan. In this series leading Japanese taxonomists will revise the various animal groups of Japan. A second volume, on the sea basses or Serranidae, has also appeared.

Watanabe's study surveys the freshwater and marine sculpins of Japan. It includes descriptions of the families, subfamilies, genera and species, but omits subspecies. A short synonymy including only references on Japan is given for each species. This is followed by a descriptive paragraph on morphology and color, the distribution in Japan and a table with 30 measured and counted characters. Five to 50 specimens of the 74 species were examined. Most of the keys are excellent in that they employ several characters. However, it is sometimes awkward to find that some characters in the couplets are unrelated.

The illustrations are superb. All of the species are depicted in the plates, 15 of which are in natural color. The text figures further elucidate structural details. The illustrations alone make this book a worthwhile purchase.

This volume is a translation of a portion of Watanabe's 1958 work. Ichthyologists will regret that the sections on comparative morphology, ecology, biogeography, embryology, phylogeny and osteology were not included in the present translation. The taxonomic treatment is conservative; only a few generic limits are modified from Matsubara's work on Japanese fishes. At least two subspecies have been raised to species. Twelve new species are named. The chief contribution is in the redescription of the sculpins of Japan and the arrangement of them in subfamilies. The latter cannot be considered complete, however, until the whole family is studied. Many errors could have been eliminated if someone with a thorough knowledge of English had read the manuscript.

One cannot help comparing *Fauna Japonica* with a similar series, *Fauna U.S.S.R.* The quality of the binding, paper and illustrations are far superior in the Japanese work. It is hoped that the Japanese example will lead to the support of similar richly illustrated works on Canadian fauna.

D. E. MCALLISTER
National Museum of Canada

The Map That Grew

By SELWYN DEWDNEY, Toronto, Oxford University Press, 1960. 32 p. $2.75.

In the field, the laboratory or the armchair maps find their place with manuals as necessary tools of the naturalist. Then, over the years, maps pass from being sheets of keen and fascinating interest and become, at least for this reviewer, objects of warm and constant affection.

The Map That Grew attempts to introduce to young children, in story form, what grandpa calls "one of the finest reading pleasures a man can enjoy." And the maps in particular, the excellent ones of our government's Topographical Survey, can rightly be given such high evaluation.

Regrettably, the expectation just isn't fulfilled. The characters don't come to life. The story has the same lack of joy, eagerness and excitement that the boys show in the author's illustrations of them. The bird's-eye views are moderately successful and the bits of cartography are good. But unless in thumbing over the pages a young child finds a natural curiosity aroused by the symbols and other conventions of the map maker he may want to wait several years before he again tries to explore the magic world of maps.

ROBERT A. HAMILTON

The Relationship of the Peary and Barren Ground Caribou

By T. H. MANNING. Montreal, Arctic Institute of North America, 1960. 52 p. Price: to members of the Institute, $1.00; to nonmembers $2.00 (Tech. Pap. arctic Inst. N. Amer. 4)

To those readers who adhere to the cliché—lies, more lies and statistics—this booklet is not recommended! Readers who do digest the 25 tables and nine figures will discover that it is a detailed statistical analysis of samples from four different caribou populations. Morphological variation in the caribou populations of the Queen Elizabeth Islands, Banks Island, Dolphin and Union Strait herd and the mainland barren-ground caribou are studied by means of complex variance and covariance analyses.

The author concludes that *Rangifer pearyi* of the Arctic Islands and *Rangifer arcticus* of the mainland are conspecific and the former should be known as *R. a. pearyi*. He also concludes that the Banks Island and Dolphin and Union herds are intergrades between the two subspecies. The Banks Island ones are clearly closer to *pearyi*, whereas the Dolphin and Union herd is tentatively considered related to the continental *arcticus*. Manning also summarizes the historical accounts of the probable extinction of the herd, which formerly migrated to Victoria Island across Dolphin and Union Strait.

A. W. FRANK BANFIELD

NOTES

Breeding Range Extensions of Two Ellesmere Island Birds

FROM MAY 31 to August 20, 1958, I was a member of the Canadian International Geophysical Year team at the Defence Research Board camp at Lake Hazen, northern Ellesmere Island. There I kept notes on the biology of the area, including records of the birds. The following records pertain only to extensions of breeding range, as the avifauna was essentially the same as that found at Eureka by myself and by MacDonald at Alert, in 1951 (Godfrey, W. E., Can. Field Nat. 67: 89-93, 1953).

BAIRD'S SANDPIPER *Erolia bairdii*. The species appeared late in the spring; the first individuals (two) arrived on June 29, and the species was seen on only three subsequent occasions. On July 28 an adult and a chick were found beside a small pond one mile north of the base camp. This finding is believed to constitute a northern breeding record for the species. Another adult was found on August 3, seven miles north of the lake, calling and displaying as if it had young. The third observation was that of a solitary bird seen on July 29 on the Snow Goose River delta.

LAPLAND LONGSPUR *Calcarius lapponicus*. An adult female was observed on July 24 on the delta between the Abbé and Snow Goose rivers. The bird was collecting insects, chiefly moths, to feed its one flightless offspring. A second adult appeared on the scene when an Arctic fox trotted by, searching for food. A female and one flying young bird, believed to be the same pair, were observed in the same area on July 31. The previous northern breeding record was obtained in 1951 at Eureka.

JOHN S. TENER
Canadian Wildlife Service
Ottawa, Ontario
10 December 1959

Further Records of the Eastern Blacknose Dace in Nova Scotia

WHILE investigating fresh-water fishes for the Nova Scotia Museum of Science in 1955 the author and J. S. Erskine collected the eastern blacknose dace (*Rhinichthys atratulus atratulus*) from five localities new for this species in Nova Scotia.

In Cumberland County the dace were taken in Atkinson Brook, a stream near Dewar Lake, at the junction of Highway

No. 4 and the road to Salt Springs, and in the Pugwash River at Hansford. The fifth locality is the French River at Oliver, Colchester County.

The Atkinson Brook collection represents the first Nova Scotia record for the species from the Bay of Funday drainage basin.

FRANCIS R. COOK*
Perry Biological Laboratories
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Wolfville, Nova Scotia
26 February 1960
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Courtship of Great Horned Owls

ON DECEMBER 6, 1959, I was wakened at 7.15 a.m. by the hooting of Great Horned Owls, *Bubo virginianus*, outside my home in Pickering, Ontario. After listening for a minute or so I adjusted the Venetian blinds to look out and saw the two owls perched on top of the highest tree at the edge of our forest about 100 yards to the east. Both owls appeared to be looking at the house, perhaps alerted by the movement of the blinds. However, the hooting continued. The upper bird, presumably the male, appeared a little smaller than the lower, presumably its mate. One bird called with deep-toned hoots "hoo-hoohoo-hoo", the other with higher-pitched, somewhat broken and guttural hoots "ha-ha, g'l-ha, ha". My wife, who helped observe, thinks that the top bird uttered the high-pitched hoots and the lower bird the deep hoots.

Both birds bowed while calling, the upper bird very pronouncedly so, with its tail cocked at right angles to the body. The lower bird bowed just perceptibly and elevated its tail only slightly when calling. Both birds flushed, the lower one first, when I turned on lights in the far side of the house to find equipment to try to record the performance. They were not so intent upon their courtship as to forget their customary caution. Similar hooting was heard across the valley to the west of the house late on the evening of December 17, at 11.45 p.m. It was interesting to observe courtship while day lengths were still decreasing and a month or two before the normal nesting time of this species.

J. MURRAY SPEIRS
Department of Zoology
University of Toronto
8 January 1960

Starling Feeds Nestling Robins

DURING the spring and summer of 1959 a pair of Starlings, *Sturnus vulgaris*, persistently attempted to nest in the upper end of a downspout on a building at Vineland Station, Ontario. Apparently the nest was repeatedly washed down by rains, for the birds continued to carry materials to the site at intervals for at least two months. One of the birds was also heard trying to escape from the bottom of the downspout and must have died in the drain below, but it was soon replaced by another.

About August 17 a Starling was seen feeding young Robins, *Turdus migratorius*, in a nest in a tree about 20 feet from the downspout. No adult Robins were noticed then or later about the nest. The Starling, or possibly the pair, continued to feed the Robins until August 25, when one nestling was found dead under the nest and the only survivor, fully fledged, stood on the nest exercising its wings at 5 p.m. At 8.30 a.m. the next day the nest was empty and a fledgling Robin, almost undoubtedly the one from the nest, was calling from a tree about 100 feet away. It continued to call incessantly from this tree and later from a nearby one throughout the day, and was apparently not fed. The Starlings remained on their territory about the building and the tree holding the Robin's nest. The Robin must have perished during the night as it could not be found the next day.

Feeding of nestlings by birds of another species is not very unusual; the interesting feature of the present instance is that the foster parent ignored the

fledgling after it had left the nest. Among possible explanations for this behavior is the character of the fledgling's call, for the hunger calls of young birds must play an important role in stimulating the parents' attentions. The voices of most passerine nestlings have a general similarity, but by the time a Robin leaves the nest its call has become very different from that of a young Starling, and in the present case did not release the parental drive of the fosterer after the fledgling had left its original place in the nest.

WILLIAM L. PUTMAN

Vineland Station, Ontario
9 February 1960

Red Phase of the Red-backed Salamander from New Brunswick

THREE distinct color phases of the red-backed salamander, *Plethodon cinereus cinereus*, are recognized. They have been distinguished as red-backed, lead-backed and scarlet by Reed (Copeia 3: 253-254, 1955). The authors propose that the terms *striped*, *lead* and *red* are more concise and descriptive, at least for Canadian material. These may be briefly characterized as follows:

Striped: Dorsal stripe red; lateral stripe black; venter mottled black and white.

Lead: Dorsal and lateral stripes black; venter mottled black and white.

Red: Dorsal stripe red; lateral stripe more or less light-brown with dominant or obscured red pigmentation; venter white, with or without partially transparent patches.

The colors red and black, as used here, are relative terms. The exact hue varies considerably in different specimens.

Over 400 specimens of the species, mostly from Nova Scotia, have been collected by the authors in the Maritime provinces of Canada. The striped phase appears to predominate. Two specimens taken in Annapolis County, Nova Scotia (Bleakney and Cook, Copeia 2: 143, 1957), constitute the only previous record of the *red* phase in the Maritimes.

In June 1958, the authors collected in southeastern New Brunswick for the National Museum of Canada and discovered a second locality for the *red* phase. Of a series of 19 specimens of *Plethodon c. cinereus* taken June 4, approximately two miles west of the headquarters building, Fundy National Park, 7 were the *red* phase and the other 12 the *striped* phase. The area was previously partly cleared land, but is now mostly filled in with second growth. All the *red* specimens and most of the *striped* ones were found under stones that banked two seepage or spring holes. These were in an open area. The salamanders showed a ready inclination to take to the water when they were exposed and several escaped by this means. The remainder of the striped individuals were found under logs and stones in the adjoining area.

The *red* individuals showed a gradation in the intensity of red coloring and clearness of the brown lateral stripe. This gradation ranged from an all-red specimen with a barely discernible lateral stripe to a distinctly brown-sided individual which had only traces of red on the lateral aspect. Dispite the dark sides of some examples of the *red* phase, all could be easily distinguished from the *striped* phase in which the sides are black and do not show any trace of red coloration.

FRANCIS R. COOK* AND
J. SHERMAN BLEAKNEY

Perry Biological Laboratories,
Acadia University, Wolfville,
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26 February 1960

*Present address: National Museum of Canada, Ottawa, Ontario

Long-billed Marsh Wren in Sibley Park, Ontario

IN THE EVENING of May 23, 1959, at Pickerel Lake, Sibley Park, Ontario, I saw a Long-billed Marsh Wren *Telmatodytes palustris*. My wife recognized the song, and later the identification of the species was confirmed by Sinclair and Robert Robb and by Dr. A. E. Allin.

The following day we returned to the area and saw two of these Long-billed Marsh Wrens. One put on a display but the two birds were not seen together. They did not approach within twenty feet of each other. On June 7 my wife and I saw one carrying nesting material. On June 14 David Allin and I found 10 false nests of this species. At times the bird approached within a foot of our canoe. The five nests found in the same locality on July 5 were believed to be additional. On July 18 I found six nests in a part of the area not previously searched and on July 25 my son and I found three more. None were occupied. The wren seen on August 3 had food in its bill.

Most of the nests were attached to dried cattails (*Typha latifolia*) and the openings were often within twelve inches of the surface of the water. This distance is less than the "one to three feet" mentioned by Bent in his *Life Histories of North American Nuthatches, Wrens, Thrashers and their Allies*. Beaver activity at the outlet of the lake had made the water higher than it had been in 1958. All nests were located within an area 100 yards long by 100 feet wide. Redwinged Blackbirds nested in the same area, and throughout the breeding season Blue-winged Teal, American Bittern, Sora, Virginia Rail and Belted Kingfisher were present.

This is the first record of the Long-billed Marsh Wren in Thunder Bay District. Though it definitely nests there is no proof of successful breeding. The unusual number of false nests is of interest.

KEITH DENIS

317 Morse Street
Port Arthur, Ontario
19 March 1960

CHECKLIST OF AMERICAN AMPHIBIANS AND REPTILES

The American Society of Ichthyologists and Herpetologists announces the preparation of a new edition of the "Checklist of American Amphibians and Reptiles." The work of many specialists, it will have greater detail than any previous edition. Loose-leaf binding will allow continuous revision. The preparation of the new list is under the guidance of a checklist committee. The chairman and editor is William J. Riemer, Florida State Museum, Flint Hall, University of Florida, Gainesville.

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NEW PLANT RECORDS FROM THE UPPER MACKENZIE RIVER VALLEY, MACKENZIE DISTRICT, NORTHWEST TERRITORIES*

W. J. CODY
Plant Research Institute, Ottawa, Ontario

IN 1955 the author, assisted by Mr. J. M. Matte, undertook a botanical survey in the vicinity of Fort Simpson, at the junction of the Liard and Mackenzie rivers in southwestern Mackenzie District. In addition to the large number of specimens collected in the immediate vicinity of Fort Simpson, specimens were collected as far up the Mackenzie River as Fort Providence, some 150 miles to the southeast, and downstream some 30 miles.

Among these collections were numerous specimens representing considerable extensions to previously known ranges, filling of gaps in previously known ranges and recent introductions. These are recorded in the present paper.

The main localities from which specimens are cited are as follows: Fort Providence, 61°17′N 119°47′W; Mills Lake Camp, 61°18′N 118°40′W; Browning's farm on south shore of Mackenzie River, 2 miles east of Trout River, 61°17′N 119°47′W; Fort Simpson, 61°62′N 121°22′W.

A complete set of the specimens collected during this expedition is preserved in the Herbarium of the Department of Agriculture at Ottawa (DAO). Unless otherwise stated in the text, the collection numbers cited throughout this paper are those of the author.

EQUISETACEAE

EQUISETUM PALUSTRE L. Common in sand at water's edge, Browning's farm, south shore of Mackenzie River, 2 miles east of Trout River, *8634;* fairly common in rich black moist humus in clearing in *Picea mariana* bush on mainland about 2 miles south of Fort Simpson island, *9137;* moist silt among *Salix interior* near water's edge, downstream from Royal Canadian Corps Signals Transmitters, Fort Simpson, *8268;* common on low sand and silt flats at upper end of island, Fort Simpson, *9331.*

With the exception of Hooker's record "to the shores of the Arctic Sea," previously unknown along the Mackenzie River between Great Slave Lake and Norman Wells (Cody, 1960), but certainly to be expected there.

EQUISETUM FLUVIATILE L. Borders of small pond with *Typha latifolia* and *Hippuris vulgaris,* not common, near Royal Canadian Corps Signals Transmitters, Fort Simpson, *8408;* common in wet moss by small lake near Royal Canadian Corps Signals Transmitters, Fort Simpson, *8424.*

Recorded by Hooker "... to the shores of the Arctic Sea," but otherwise unknown from the Mackenzie River valley between Great Slave Lake (Raup, 1947) and Norman Wells (Cody, 1960).

*Contribution No. 21 from the Plant Research Institute, Research Branch, Canada Department of Agriculture, Ottawa, Ontario

Mailing date of this number: 9 June 1961

PINACEAE

PINUS BANKSIANA Lamb. Trees to 35 ft.; our specimens from small 8-ft. tree along road; common forest tree in sand on mainland about 1 mile south of Fort Simpson island, *9125*.

This is the second substantiated record for the species below Great Slave Lake. See Raup (1947) and Cody (1956) for discussions on the occurrence of *Pinus banksiana* in the Mackenzie valley.

TYPHACEAE

TYPHA LATIFOLIA L. Common in shallow water and muck of drying up sloughs near Royal Canadian Corps Signals Transmitters, Fort Simpson, *8904*; small clone rooted in muck in shallow water at edge of small slough in bush on mainland 1 mile south of Fort Simpson island, *9114;* small clone in shallow water of small pond among sand hills on south shore of Mackenzie River about 16 miles downstream from Fort Simpson, *8931*.

Not previously collected in the area between Great Slave Lake (Cody, 1956) and Norman Wells (Cody, 1960) but certainly to be expected there in suitable habitats.

SPARGANIACEAE

SPARGANIUM MULTIPEDUNCULATUM (Morong) Rydb. Rooted in muck in shallow water of small slough near Royal Canadian Corps Signals Transmitters, Fort Simpson, *9267*, *9345;* almost dry pond gouged out along road through *Picea mariana* bush about 3 miles southeast of Fort Simpson, *9233;* one plant only in wet sand by small pond among sand hills on south shore of Mackenzie River about 16 miles downstream from Fort Simpson, *8936*.

Occasional in the Fort Simpson region; not previously recorded between Great Slave Lake (Raup, 1936) and Fort Franklin (Raup, 1947).

SPARGANIUM MINIMUM Fries Floating in shallow water around borders of small slough in bush on mainland about 1 mile south of Fort Simpson island, *9102*.

This is only the second Mackenzie River collection with exact locality data. The species occurs as far north as Norman Wells (Cody, 1960).

POTAMOGETONACEAE

POTAMOGETON FILIFORMIS Pers. var. BOREALIS (Raf.) St. John In shallow water of small pond among sand hills on south shore of Mackenzie River about 16 miles downstream from Fort Simpson, *8932*, *8967*.

Not previously recorded from the area between Great Slave Lake (Cody, 1956) and Norman Wells (Cody, 1960).

POTAMOGETON ALPINUS Balbis var. TENUIFOLIUS (Raf.) Ogden Common in shallow water around border of slough near Royal Canadian Corps Signals Transmitters, Fort Simpson, *9019;* fairly common in shallow water rooted in muck of small slough in bush about 1 mile south of Fort Simpson island, *9109;* small pond behind sand hills on south shore of Mackenzie River about 16 miles downstream from Fort Simpsón, *8966*.

Not previously recorded along the Mackenzie River between Great Slave Lake (Raup, 1947) and Norman Wells (Cody, 1960).

POTAMOGETON PRAELONGUS Wulf. Rare, floating along shore of Mackenzie River by mouth of Harris Creek, opposite Fort Simpson, *8863*.

Not previously recorded from the area between Great Slave Lake and Eskimo Lakes basin (Raup, 1947), but certainly to be expected there.

ALISMACEAE

SAGITTARIA CUNEATA Sheldon Rooted in shallow water around border of slough near Royal Canadian Corps Signals Transmitters, Fort Simpson, *9017*, *9270*.

Not previously recorded from the upper Mackenzie River, but certainly to be expected there; the species is now known to occur at four localities in Mackenzie District, the other three being on the shores of Great Slave Lake (Cody, 1956).

GRAMINEAE

BROMUS INERMIS Leyss. Occasional patches in light sandy soil of waste ground near Royal Canadian Corps Signals Buildings, Fort Providence, *8532;* common along edge of oat field, R. C. Mission farm, Fort Simpson, *9077;* very common along roadsides throughout the settlement, Fort Simpson, *8382;* old field behind Hudson Bay Co., Fort Simpson, *8769*.

Introduced, not previously recorded north of Hay River, from where it was first recorded as occurring in Mackenzie District (Cody, 1956).

FESTUCA RUBRA L. Edge of field, Experimental Farm, Fort Simpson, *8791;* common along drainage ditch through Experimental Farm plot area, Fort Simpson, *8693.*

These specimens represent cultivated strains of the species.

GLYCERIA GRANDIS S. Wats. In shallow water and muck of drying up slough near Royal Canadian Corps Signals Transmitters, Fort Simpson, *8907.*

Not previously recorded in Mackenzie District downstream from Great Slave Lake (Cody, 1956).

PUCCINELLIA DISTANS (L.) Parl. A few clumps in garden, more or less flattened to the ground, Experimental Farm, Fort Simpson, *8435.*

Presumably introduced; not previously recorded for Mackenzie District.

PUCCINELLIA NUTTALLIANA (Schultes) Hitchc. Rare in cleared ground by Community Centre, Fort Simpson, *8781;* rare in wet sand of hollow in sand hills on south shore of Mackenzie River about 16 miles downstream from Fort Simpson, 61°58'N 121°45'W, *8989.*

Not previously recorded along the Mackenzie River between Great Slave Lake (Raup, 1936, 1947) and Norman Wells (Cody, 1960).

POA INTERIOR Rydb. A few clumps in light sandy soil at top of bank overlooking Mackenzie River, Fort Providence, *8542;* rare in sandy gravel near shore, Mills Lake Camp, south shore of Mackenzie River, *8595, 8589;* very common in abandoned field behind Hudson Bay Co., Fort Simpson, *8372, 8373, 8764;* along top of bank overlooking Mackenzie River near Hudson Bay Co., Fort Simpson, *8304, 8305;* in sand of trail up mainland slope south of Fort Simpson island, *9044, 9074;* occasional in disturbed sand along road cut through *Picea glauca-Larix-Populus tremuloides* bush on mainland south of Fort Simpson island, *9094;* common in clumps in disturbed sand along roadside on mainland about one mile south of Fort Simpson island, *9134.*

Fairly common throughout the Fort Simpson area; not previously recorded from the area between Great Slave Lake (Cody, 1956) and Norman Wells (Cody, 1960). Specimens cited under *Poa nemoralis* from Brintnell Lake by Raup (1947) may also belong here.

POA COMPRESSA L. Cleared ground along road through bush near Community Centre, Fort Simpson, *8744.*

Introduced; not previously recorded from north of Fort Smith (Raup, 1936); the second record for Mackenzie District.

AGROPYRON TRACHYCAULUM (Link) Malte var. GLAUCUM (Pease & Moore) Malte Small clumps, rare in moist, humus-rich, black ground pushed up by bulldozer at border of field and bush, R.C. Mission farm, Fort Simpson, *8899;* among *Populus, Amelanchier* and *Cornus* in open bush behind Anglican Mission, Fort Simpson, *8712;* old field behind Hudson Bay Co., Fort Simpson, *8766;* a few clumps in disturbed sand along roadside on mainland about 1 mile south of Fort Simpson island, *9133;* occasional on steep open slope of Mackenzie River among *Arctostaphylos uva-ursi* opposite Fort Simpson, *8854.*

Not previously recorded from the area between Great Slave Lake (Cody, 1956) and Norman Wells (Cody, 1960).

AGROPYRON SERECEUM Hitchc. Common along bank of Mackenzie River in front of settlement, Fort Simpson, *8818, 8819;* a few plants on open grassy bank of Mackenzie River upstream from Hudson Bay Co., Fort Simpson, *8669;* rare at top of bank overlooking junction of Liard and Mackenzie rivers, Fort Simpson, *8672;* on lower slope of Mackenzie River near Hudson Bay Co. docking area, Fort Simpson, *8771;* very common on steep bank of Mackenzie River below Anglican Mission, Fort Simpson, *8395;* fairly common in sandy silt of *Salix interior* flats on south side of island, Fort Simpson, *8839.*

Previously recorded from Mackenzie District at Norman Wells (Cody, 1960). This species will no doubt be found in the intervening area along the Mackenzie River and also along the Liard, by which route it possibly traveled from the west. The type was collected at Dawson, Yukon.

AGROPYRON REPENS (L.) Beauv. Common along roadside on well-drained embankment, Lower Hay River, *Lewis 874* (DAO); exposed bluff near road, common, Lower Hay River, *Lewis 875* (DAO); exposed well-drained waste area, common, Alexandra Falls on Hay River, *Lewis 934* (DAO); rare in garden in light sandy soil, Browning's farm on south shore of Mackenzie River 2 miles east of Trout River, *8640;* a few large patches along fenceline of R.C. Mission farm, Fort Simpson, *8686.*

Introduced; not previously recorded from north of Fort Smith in Mackenzie District (Cody, 1956).

× AGROHORDEUM MACOUNII (Vasey) Lepage, *Elymus macounii* Vasey Occasional in open field in townsite, Lower Hay River, *Lewis 873* (DAO); occasional clumps in light sandy soil of cleared ground around buildings, Mills Lake Camp, south shore of Mackenzie River, *8604;* scattered clumps in light sandy soil of waste ground near Royal Canadian Corps Signals buildings, Fort Simpson, *8525;* rare in old field behind Hudson Bay Co., Fort Simpson, *8659;* rare at top of bank overlooking junction of Liard and Mackenzie River, Fort Simpson, *8673;* in sod of cabin clearing on top of bank overlooking Mackenzie River opposite Fort Simpson, *9322;* common in cabin clearing at mouth of Martin River about 8 miles downstream from Fort Simpson on Mackenzie River, *8991.*

Not previously recorded from the area between Salt Plain west of Fort Smith (Cody, 1956) and Norman Wells (Cody, 1960).

ELYMUS SIBIRICUS L. A few plants on open grassy bank of Mackenzie River upstream from Hudson Bay Co., Fort Simpson, *8668.*

See Bowden and Cody (in preparation) "Recognition of *Elymus sibiricus* from Alaska and the District of Mackenzie"; possibly introduced, new to the flora of Mackenzie District.

ELYMUS SIBIRICUS L. f. MONOSTACHYUS Hultén Dry ridge burnt over in 1943, Liard River at mouth of Nahanni River, *F. S. Nowosad, 3,* July 19, 1944 (DAO).

See entry above; possibly introduced, new to Mackenzie District.

SPHENOPHOLIS INTERMEDIA (Rydb.) Rydb. Rare in sand along trail up mainland slope south of Fort Simpson island, *9046.*

This is a northwestward extension of range of some 200 miles from Alexandra Falls on Hay River (Cody, 1956). It is the second record for Mackenzie District.

CALAMAGROSTIS PURPURASCENS R. Br. Clumps in sand in mat of *Arctostaphylos uva-ursi* under open *Pinus banksiana* along road on mainland south of Fort Simpson island, *9096.*

Not previously recorded along the upper Mackenzie River.

AGROSTIS GIGANTEA Roth By slough in pasture, Experimental Farm, Fort Simpson, *8789.*

This is the common redtop which has been introduced here; it was only noted once on the island; new to the flora of Mackenzie District.

AGROSTIS ? IDAHOENSIS Nash Under brush along back road, Fort Simpson, *8803.*

Rare; found only once in the area. The branches of the panicle branch near or below the middle, the spikelets are smaller than *A. scabra* (1.5-1.9 mm) and the whole plant is a lighter green, hence the collection seems best placed here. *A. idahoensis* has not previously been recorded from Mackenzie District. The range of this species as given by Hultén (1942) is "Alaska to the mts. of California (34°N.) eastwards to New Mexico, W. Montana and Alberta, also on Gaspé Penins. and at the Gulf of St. Lawrence."

PHLEUM PRATENSE L. Occasional in light sandy soil of slope of river among *Alnus* and *Salix,* Browning's farm on south shore of Mackenzie River 2 miles east of Trout River, *8635;* a few plants by roadside at top of bank overlooking Mackenzie River downstream from settlement, Fort Simpson, *8403;* rare in cleared ground near Royal Canadian Corps Signals Transmitters, Fort Simpson, *8705.*

Introduced; previously known in Mackenzie District from Fort Smith, Alexandra Falls, Lower Hay River and Yellowknife (Cody, 1956). This species will no doubt eventually be found in most of the settlements along the Mackenzie River valley.

ORYZOPSIS PUNGENS (Torr.) Hitchc. Occasional in disturbed sand along road cut through *Picea glauca—Larix—Populus tremuloides* bush on mainland south of Fort Simpson island, *9093.*

This is a northwestward extension of range of some 325 miles from Fort Smith (Cody, 1956).

STIPA SPARTEA Trin. var. CURTISETA Hitchc. North side of mouth of Rabbitskin R. east of Simpson, *W. J. Stewart s.n.* Aug. 5, 1941 (DAO); localized on slope in old field behind Hudson Bay Co., Fort Simpson, *9026.*

Not previously recorded from north of Fort Vermilion in northern Alberta (Cody, 1956); this is a northwestward extension of range of some 300 miles; new to the flora of Mackenzie District.

SPARTINA GRACILIS Trin. Rare in hard clay among stones at edge of high water mark of Mackenzie River at mouth of Harris Creek, opposite Fort Simpson, *8869.*

Raup (1947) recorded a Gray Herbarium specimen collected by Richardson which

bears the data "Cumberland House to Bear Lake." The northernmost collection with definite locality data, seen by Raup (1947) was from Resolution on Great Slave Lake.

PHALARIS ARUNDINACEA L. Rare in sandy gravel near shore, Mills Lake Camp, south shore of Mackenzie River, *8587.*

Not previously recorded from the area between Fort Smith (Cody, 1956) and Fort Simpson (Raup, 1947).

SETARIA VERTICILLATA (L.) Beauv. Fort Simpson, *J. W. Goodall s.n.* July 16, 1934 (DAO).

A casual introduction; this specimen was forwarded to the Department for identification by Mr. Goodall, a local farmer. This species was not noted during the 1955 survey of the Fort Simpson area nor has it been recorded from elsewhere in Mackenzie District.

SETARIA VIRIDIS (L.) Beauv. A single plant in row of carrots, Goodall farm, Fort Simpson, *9002.*

A casual introduction; not previously noted in Mackenzie District.

CYPERACEAE

ERIOPHORUM RUSSEOLUM Fries var. ALBIDUM Nyl. *E. chamissonis* C. A. Mey. forma *albidum* (Nyl.) Fern. Rare in wet moss by small lake near Royal Canadian Corps Signals Transmitters, Fort Simpson, *8426.*

Not previously recorded from the area between Great Slave Lake (Raup, 1947) and Norman Wells (Cody, 1960).

SCIRPUS MICROCARPUS Presl Rare in wet silt along back channel, Fort Simpson, *9245.*

Previously known in Mackenzie District from a single collection from Resolution on Great Slave Lake some 250 miles to the east (Raup, 1947).

CAREX DIANDRA Schrank Scattered clumps in moist moss by small slough near Royal Canadian Corps Signals Transmitters, Fort Simpson, *9275, 8415, 9016;* clumps in wet moss by small slough in bush on mainland about one mile south of Fort Simpson island, *9105;* one clump in wet sand by small pond among sand hills on south shore of Mackenzie River about 16 miles downstream from Fort Simpson, *8938.*

Not previously recorded along the Mackenzie River between Norman Wells (Cody, 1960) and Great Slave Lake (Raup, 1936).

CAREX GYNOCRATES Wormskj. Rare in wet black sandy humus among other *Carex* by small slough in clearing in *Picea mariana* bush about 2 miles south of Fort Simpson island, *9161.*

This is the second collection of this species from along the Mackenzie River south of the delta (Cody, 1960).

CAREX ? TONSA (Fernald) Bickn. *C. umbellata sensu* Hook. in part Scattered clumps in disturbed sand along road cut through *Picea glauca, Larix, Populus tremuloides* on mainland south of Fort Simpson island, *9092.*

The few achenes on our over-mature specimens measure only about 2.5 mm in length, the beak is about 1.2 mm in length, and the leaves are narrower and less scabrous than specimens seen from Ontario and Quebec, nevertheless they seem better placed here than under *C. rossii* or *C. deflexa.* Richardson (1851) noted *C. umbellata* as occurring at Fort Simpson but Raup (1947) reported that this early record was the only evidence of the occurrence of this plant north of Lake Athabaska.

CAREX PAUPERCULA Michx. (inc. var. *irrigua* (Wahl.) Fern.) Clumps in wet moss by slough in bush on mainland about one mile south of Fort Simpson island, *9104.*

Not previously recorded from the Mackenzie River between Great Slave Lake (Raup, 1936, 1947) and Norman Wells (Cody, 1960).

CAREX ATHERODES Spreng. Depression in cleared ground around buildings, Mills Lake Camp, south shore of Mackenzie River, *8615;* very large stand one mile long in moist black ground of prairie about 5 miles southeast of Fort Simpson, *9175.*

Raup (1947) recorded only three collections from Mackenzie District: Fort Liard, Lower Slave River and Mackenzie River; the Mackenzie River collection was made by Richardson who, as is the case with most of his collections, did not record the exact locality from which it was obtained. Our collections are therefore the first Mackenzie River collections with exact locality data.

CAREX ROSTRATA Stokes, *C. ampulacea sensu* Hooker Fairly common in shallow water rooted in muck at border of slough near Royal Canadian Corps Signals Transmitters, Fort Simpson, *9020;* in moist moss by small slough near Royal Canadian Corps Signals Transmitters, Fort Simpson, *9276;* in wet moss bordering slough in bush on mainland about one mile south of Fort Simpson island, *9115;* moist sand in hollow of sand hills on south shore of Mackenzie River about 16

miles downstream from Fort Simpson, *8939*.

With the exception of the Richardson specimen cited by Raup (1947) "Mackenzie River," this species has not been recorded along the Mackenzie River between Great Slave Lake (Raup, 1947) and Norman Wells (Cody, 1960).

CAREX RETRORSA Schwein. One plant half buried in silt washed down along river shore along lower part of island, Fort Simpson, *9344*.

Previously known in Mackenzie District from a single collection from Fort Liard some 150 miles to the southwest (Raup, 1947).

LEMNACEAE

LEMNA TRISULCA L. Common, immersed in shallow water among *Hippuris vulgaris*, *Equisetum fluviatile* and *Typha latifolia* in small pond near Royal Canadian Corps Signals Transmitters, Fort Simpson, *8407*.

Not previously recorded between Great Slave Lake (Cody, 1956) and Mackenzie River delta (Porsild, 1943).

LEMNA MINOR L. Common, floating among *Hippuris vulgaris*, *Equisetum fluviatile* and *Typha latifolia* in small pond near Royal Canadian Corps Signals Transmitters, Fort Simpson, *8406*.

Not previously recorded in the Mackenzie system below Great Slave Lake (Raup, 1936).

LILIACEAE

SMILACINA STELLATA (L.) Desf. Common on stream bank under *Salix*, Salt River, 60°06′N 112°15′W, *4484;* scattered under shrubby birch and willow bordering saline plains, Salt Plain west of Fort Smith, *3788;* occasional on sheltered dry slope of river-bank, West Channel, Hay River, *Lewis 519* (DAO); rare on open bank of Mackenzie River, Fort Providence, *8558;* common among low shrubbery on flats of Harris Creek, opposite Fort Simpson, *8731*.

Not previously recorded from the area between Wood Buffalo Park, [Alberta] (Raup, 1935, 1936), Brintnell Lake (Raup, 1947) and Great Bear Lake (Porsild, 1943).

ORCHIDACEAE

GOODYERA REPENS (L.) R. Br. Rare in deep moist moss in *Picea glauca* woods about 5 miles southeast of Fort Simpson, *9195*.

Specimens with leaves both lined (var. *ophioides* Fern.) and unlined (var. *repens*) were found growing together in this colony. The unlined were perhaps somewhat more deeply imbedded in the surrounding moss, which may possibly have been the reason for the lack of lines. Raup (1947) stated that his Brintnell Lake collections had the leaves distinctly mottled and also that material from the Athabaska—Great Slave Lake region had mottled leaves. Hooker recorded that *G. repens* ranged from the Saskatchewan to Fort Franklin and the leaves were rarely reticulated with white veins. A sheet collected in moss in shady white spruce woods at Fort Smith, *Loan 64* (DAO), has no white lines on the leaves.

SALICACEAE

SALIX SERISSIMA (Bailey) Fern. Rare at water's edge, Indian Village on north shore of Mackenzie River, 61°14′N 119°18′W, *8629;* on hummock by small lake near Royal Canadian Signals Transmitters, Fort Simpson, *8432*, *8433*.

Only one male and one female shrub were seen at the Fort Simpson location; not previously recorded from the area between Fort Smith (Cody, 1956) and Norman Wells (Cody, 1960) but certainly expected to be there.

SALIX LASIANDRA Benth. var. LASIANDRA Shrubs 4 to 7 ft., rare on river flats at junction of Liard and Mackenzie rivers, Fort Simpson, *8221*, *8222*, *8223*, *8681;* shrub 5 ft., rare in elongate depression near south side of island, Fort Simpson, *8122;* shrub 10 ft., rare on lower part of bank of Mackenzie River downstream from settlement, Fort Simpson, *8231*.

This is an extension of range of some 150 miles downstream from Fort Providence for the typical variety. Var. *lasiandra* and the pubesent twigged var. *recomponens* which Raup (1947) described from the Fort Simpson area are about equally common there.

SALIX ATHABASCENSIS Raup Shrub 3-4 ft., fairly common around border of small slough in bush on mainland about 1 mile south of Fort Simpson island, *9124*.

Not previously recorded from the area between the type locality at the Moose Lake ranger station in Wood Buffalo Park [Alberta] (Raup, 1936) and Norman Wells (Cody, 1960).

SALIX BEBBIANA Sarg. Shrub 20 ft., cut over area along back road, Fort Simpson, *8083*, *8200*, *8379;* shrub 5 ft. along fenceline behind Experimental Farm buildings, Fort

Simpson, *7992, 8189*; shrub 3 ft., occasional on bouldery bank of Mackenzie River opposite Fort Simpson, *8453*.

Capsules of the specimens cited here were reddish-green rather than yellowish-green; the glands were bright-red on the fresh specimens and dried maroon, rather than yellow-green; approximately 5% of the *Salix bebbiana* population in the Fort Simpson region belonged to this red-fruited phase, which might possibly represent a distinct geographic variety.

SALIX PEDICELLARIS Pursh var. HYPOGLAUCA Fern. Shrub 3 ft., fairly common around borders of small slough in bush on mainland about 1 mile south of Fort Simpson island, *9120*.

Previously known in Mackenzie District from only two collections: Fort Franklin (Raup, 1947) and Yellowknife (Cody, 1956).

SALIX SCOULERIANA Barratt var. COETANEA Ball, *S. nuttallii* Sarg. Shrub 10 ft., rare on border of cleared ground by airstrip, Fort Simpson, *8127;* shrub 20 ft., cut over area along back road, Fort Simpson, *8084, 8201, 8497;* a single 4 ft. shrub in scrub area along roadside at top of bank overlooking Mackenzie River downstream from settlement, Fort Simpson, *8066;* shrub 12 ft., rare in tangled mass of *Salix* and *Alnus* behind beach on Mackenzie River shore downstream from Royal Canadian Corps Signals Transmitters, Fort Simpson, *8277;* shrub 12 ft., rare in wet ground upstream from town, Fort Simpson, *8022;* shrub 20 ft., top of bank overlooking Mackenzie River, Indian Village 30 miles downstream from Fort Simpson, *8170*.

Only very occasional in the Fort Simpson area; *S. nuttallii* was reported as collected there by Preble (1908), but Raup (1947) reported that he did not find it there in 1939. *S. scouleriana* var. *coetanea* is known along the Mackenzie River from only these collections and is not known further east in Mackenzie District; to the west it is found in the Mackenzie mountains and Yukon Territory (Raup, 1947, Porsild, 1951).

SALIX PSEUDOMONTICOLA Ball Shrub 5 ft., low ground by small creek, Mackenzie River about 23 miles upstream from Fort Simpson, *8101, 8102;* shrub 5 ft., rare at edge of clearing on slope leading down to Liard River, Fort Simpson airport, *8350;* shrub 4 ft., rare on slope of Mackenzie River, Fort Simpson, *8033;* shrub 15 ft., along road through bush, Fort Simpson, *8115A;* in disturbed ground near community centre, Fort Simpson, *8115B;* shrub 3 ft., river flats at junction of Liard and Mackenzie rivers, Fort Simpson, *8091;* shrub 10 ft., along fenceline behind Experimental Farm buildings, Fort Simpson, *7991, 8186*; shrub to 4 ft., rare on bank overlooking Mackenzie River downstream from settlement Fort Simpson, *8056, 8224;* shrub 10 ft., scattered along roadside downstream from settlement, Fort Simpson, *8696*; shrub 5 ft., among scrub by roadside near Royal Canadian Corps Signals Transmitters, Fort Simpson, *8149;* shrub 6 ft., in thick *Salix—Alnus—Cornus* bush by Harris Creek, opposite Fort Simpson, *8486;* shrub 6 ft., on sand hills on south bank of Mackenzie River approximately 16 miles downstream from Fort Simpson, *8161*.

This is an extension of range of some 300 miles northwest from Fort Smith (Cody, 1956).

BETULACEAE

BETULA PUMILA L. var. GLANDULIFERA Regel Common around border of small slough in bush 1 mile south of Fort Simpson island, *9116*.

This is a northwestward extension of range of some 350 miles from Fort Smith where it was recorded by Raup (1947). The species was not seen elsewhere in the vicinity of Fort Simpson.

URTICACEAE

URTICA GRACILIS Ait. A few small patches in waste ground by Hudson Bay Co. garden, Fort Simpson, *8662*.

Hooker recorded this species "...as far as Fort Franklin on the Mackenzie River." Raup (1947), however, did not record any specimens from below Great Slave Lake.

POLYGONACEAE

RUMEX OCCIDENTALIS Watson Rare in wet moss and muck of small slough in *Salix* bush near Royal Canadian Corps Signals Transmitters, Fort Simpson, *9354;* rare in moist black ground of *Carex* prairie about 5 miles southeast of Fort Simpson, *9173*.

Not observed elsewhere in the Fort Simpson area; this is an extension of range of some 200 miles westward from the Great Slave Lake localities cited by Raup (1936). I also collected it at Norman Wells some 300 miles downstream in 1953 (Cody, 1960).

POLYGONUM ACHOREUM Blake Fairly common along roadsides and about buildings in light sandy soil, Fort Providence, *8541;*

prostrate to decumbent, common along roadsides and about buildings throughout the settlement, Fort Simpson, *9341*.

P. achoreum is a native species found from Nfld. to Alaska. In Mackenzie District it is known from Fort Smith, Hay River, Yellowknife (Cody, 1956) and the localities cited above. Since the species has only recently been found in the District, and then only in inhabited areas, it appears that it has probably been introduced in this region.

POLYGONUM CONVOLVULUS L. Rare in light sandy soil by roadside, Fort Providence, *8540;* rare in garden, Experimental Farm, Fort Simpson, *8442;* in dumping area at top of bank overlooking Mackenzie River in front of Hudson Bay Co., Fort Simpson, *8812;* very common in field of oats, R.C. Mission farm, Fort Simpson, *9076*.

Introduced; previously recorded from Mackenzie District at Fort Smith and Yellowknife (Cody, 1956).

CARYOPHYLLACEAE

CERASTIUM NUTANS Raf. var. OCCIDENTALE Boivin, *C. nutans sensu* Raup (1936) Grassy slope of river bank, Browning's farm on south shore of Mackenzie River 2 miles east of Trout River, *8515*.

This is a northwestern extension of range of some 325 miles from the east end of Lake Athabaska from where Raup (1936) has recorded *C. nutans;* new to the flora of Mackenzie District.

SILENE MENZIESII Hook. Very rare in light sandy soil among scrub *Salix* by roadside near Royal Canadian Corps Signals buildings, Fort Providence, *8549;* rare along open bank of Mackenzie, Fort Providence, *8561*.

Not previously recorded from the area between Fort Smith (Hooker, 1829-40, Cody, 1956) and Fort Simpson (Raup, 1947).

RANUNCULACEAE

ACTAEA RUBRA (Ait.) Willd. forma NEGLECTA (Gillman) Robins. Occasional in open bush behind Anglican Mission, Fort Simpson, *8822;* rare in partial shade along back road through bush, Fort Simpson, *9005;* occasional in *Salix—Populus—Picea* bush about 5 miles southeast of Fort Simpson, *9203*.

Approximately 90% of the *Actaea rubra* observed in the Fort Simpson area belonged to the white-fruited rather than the typical red-fruited form.

RANUNCULUS SCELERATUS L. var. MULTIFIDUS Nutt., *R. sceleratus* L. *sensu* Hooker Rare in dry soil by roadside in front of Experimental Farm, Fort Simpson, *8383;* occasional in dried up slough in pasture, Experimental Farm, Fort Simpson, *8739;* in ooze bordering slough and in 4-6 inches water rooted in ooze of slough near Royal Canadian Corps Signals Transmitters, Fort Simpson, *8412;* rare among bank of *Equisetum arvense* on disturbed ground by road leading down to Liard River, airport, Fort Simpson, *8345*.

The only specimen of this species recorded by Raup (1947) was from the northwest shore of Great Slave Lake. Hooker, however, gave its northern range as 67°. The author has also collected it at Norman Wells (Cody, 1960).

RANUNCULUS PENSYLVANICUS L. f. By dried up slough in pasture, Experimental Farm, Fort Simpson, *8735B*.

Rare; found only at this locality where it grew intermingled with *R. macounii;* this is an extension of range of some 350 miles northeast from near Pine Lake in Wood Buffalo Park [Alberta] where I found it in 1950 (Cody, 1956); new to the flora of Mackenzie District.

CRUCIFERAE

THLASPI ARVENSE L. A large stand in old field by Hudson Bay Co., Fort Simpson, *8652;* forming patches several yards in diameter in ground cultivated last year [1954] as well as scattered plants along fenceline, Experimental Farm, Fort Simpson, *7989;* scattered in hay field, R.C. Mission, Fort Simpson, *8208*.

An introduced weed not previously known from the area between Great Slave Lake (Cody, 1956) and Norman Wells (Cody, 1960).

LEPIDIUM BOURGEAUIANUM Thell. Exposed sand shore, common, Wrigley Harbour, Brabant Island, Great Slave Lake, *W. H. Lewis, 998* (DAO); rare in light sandy soil of cleared ground about buildings, Mills Lake Camp, south shore of Mackenzie River, *8618A;* scattered patches in light sandy soil of waste ground near Royal Canadian Corps Signals building, Fort Providence, *8535;* localized in light sandy soil around buildings, Indian Village on north shore of Mackenzie River, 61°14′N 119°18′W, *8622;* common around buildings only, light sandy soil,

Browning's Farm on south shore of Mackenzie River 2 miles east of Trout River, *8637;* upright, fairly common along roadsides and around buildings, Fort Simpson, *8398.*

See Cody (1960) for notes on the occurrence of *Lepidium* in Mackenzie District. At Fort Simpson *Lepidium bougeauianum* flowered about two weeks later than *L. densiflorum.*

LEPIDIUM DENSIFLORUM Schrad. var. DENSIFLORUM Scattered patches in light sandy soil of waste ground near Royal Canadian Corps Signals bldgs., Fort Providence, *8537;* Fort Providence, *Dutilly 8543* (DAO); rare in light sandy soil of cleared ground about buildings, Mills Lake Camp, south shore of Mackenzie River, 61°18′N 118°40′W, *8617;* one large patch in disturbed ground near community hall, Fort Simpson, *8109;* disturbed ground thrown up by bulldozer behind Community Centre, Fort Simpson, *8754;* fairly common along roadsides and around buildings, Fort Simpson, *8399.*

See notes under *L. bourgeauianum.*

CAPSELLA BURSA-PASTORIS (L.) Medic. Fairly common along roadsides and about buildings in light sandy soil, Fort Providence, *8543;* rare among *Equisetum arvense* and Gramineae in light sandy soil of cleared ground of Indian Village on north shore of Mackenzie River, 61°14′N 119°18′W, *8626;* scattered throughout gardens and about buildings in light sandy soil, Browning's Farm on south shore of Mackenzie River 2 miles east of Trout River, *8638;* rare in garden, cabin clearing at mouth of Martin River about 8 miles downstream from Fort Simpson, 61°56′N 121°35′W, *8994.*

This introduced weed will no doubt eventually be known from every clearing and settlement along the Mackenzie River. At Fort Simpson, from where Raup (1947) had recorded it, this species was quite common around buildings and in cleared areas.

CAMELINA SATIVA (L.) Crantz One plant only in light soil of garden by R.C. school, Fort Providence, *8573;* rare along border of oat field, R.C. Mission farm, Fort Simpson, *8690;* a small patch in old field behind Hudson Bay Co., Fort Simpson, *8387.*

An introduced weed, previously known in Mackenzie District only from Fort Smith (Cody, 1956).

SISYMBRIUM ALTISSIMUM L. Only one plant on almost bare hillside in pasture field, R.C. Mission farm, Fort Simpson, *8687.*

Not previously recorded from Mackenzie District: this is seemingly a casual introduction; the nearest localities from where it has been recorded are Dawson, Yukon (Porsild, 1951), North Fort Vermilion, Alta. (Groh, 1949) and Fort Saskatchewan, Alta. (Turner, 1949).

DESCURAINEA SOPHIA (L.) Webb. Common in light sandy soil of waste ground near Royal Canadian Corps Signals buildings, Fort Providence, *8524;* disturbed ground around buildings, Mills Lake Camp, south shore of Mackenzie River, *8596;* fairly common in light sandy soil of cleared ground of Indian Village on south shore of Mackenzie River 61°14′N 119°18′W, *8621;* fenceline at front of Anglican Mission, Fort Simpson, *8246;* waste ground overlooking flats, upstream from settlement, Fort Simpson, *8663;* thick stand on top of bank overlooking flats, upstream from settlement, Fort Simpson, *8303.*

An introduced weed previously known from Mackenzie District (Cody, 1956), but hitherto known in the Mackenzie River valley only from Norman Wells (Cody, 1960).

ARABIS DRUMMONDII Gray Scattered in disturbed sand along roadside about 4 miles southeast of Fort Simpson, *9219;* rare in drier part of *Carex* meadow about 4 miles southeast of Fort Simpson, *9224.*

Apparently not previously known from the lowland areas adjacent to the Mackenzie River, although it was known from the prairies of Wood Buffalo Park [Alberta] (Raup, 1936, 1947). In Mackenzie District it is also known from Brintnell Lake, Great Bear Lake and the Richardson Mountains (Raup, 1947).

ROSACEAE

POTENTILLA PALUSTRIS (L.) Scop. Common in moss in shallow water of small lake near Royal Canadian Corps Signals Transmitters, Fort Simpson, *8720;* fairly common rooted in muck in shallow water of small slough near Royal Canadian Corps Signals Transmitters, Fort Simpson, *9272;* fairly common but little in flower, in wet moss bordering small slough in bush, on mainland about 1 mile south of Fort Simpson island, *9123;* rare in moist black ground in *Carex* meadow about 5 miles southeast of Fort Simpson, *9186.*

These are the first specimens with definite locality data from between Norman Wells

(Cody, 1960) and Great Slave Lake (Raup, 1947). Raup (1947) recorded two specimens collected by *Onion, Kennicott* and *Hardesty* which he stated probably came from the upper Mackenzie, Hooker recorded this species "...as far north as Bear Lake" but it is now known to occur beyond the limit of trees (Cody, 1954a).

LEGUMINOSAE

TRIFOLIUM REPENS L. Rare in sod by house, probably seeded at one time, Fort Simpson, *8368*.

Presumably persisting after sowing; not previously recorded for Mackenzie District.

MELILOTUS OFFICINALIS Lam. var. OFFICINALIS Rare in light sandy soil of garden by R.C. School, Fort Providence, *8572*.

Introduced; previously known in Mackenzie District from Fort Smith, Lower Hay River and Yellowknife (Cody, 1956).

MELILOTUS ALBA Desr. var. ALBA Localized in light sandy soil of cleared ground by buildings, Mills Lake Camp south shore of Mackenzie River, *8602;* several large patches and numerous scattered plants on bank of Mackenzie River in front of settlement, Fort Simpson, *8816;* rough cleared ground near Royal Canadian Corps Signals buildings, Fort Simpson, *8644;* localized in moist sand of cleared ground along road through *Picea mariana* bush about 3 miles southeast of Fort Simpson, *9232*.

Introduced; noted several times in waste places at Fort Simpson; previously known in Mackenzie District from Fort Smith, Alexandra Falls on Hay River, Hay River and Yellowknife (Cody, 1956).

MEDICAGO SATIVA L. Scattered among *Bromus* in hay field, Experimental Farm, Fort Simpson, *8384*.

This was undoubtedly a survival from an experimental planting; previously known in Mackenzie District from Alexandra Falls on Hay River and Fort Smith (Cody, 1956).

ASTRAGALUS ABORIGINORUM Rich. var. ABORIGINORUM Rare on gravel shore, south shore of Mackenzie River at Trout River, 61°18′N 119°51′W, *8513*.

There is a Richardson specimen (CAN) labeled "Gravelly ridges, north to Bear Lake" which possibly was collected in Mackenzie District. Raup (1947) doubtfully referred an immature specimen from Fort Simpson to this taxon. Our specimen is thus the first recorded collection of this species with accurate locality data from Mackenzie District. Hooker gave the range for *Phaca aboriginorum* as "From Lake Winnipeg to the Rocky Mountains, and as far north as Bear Lake, in lat. 66°".

ASTRAGALUS EUCOSMUS Robinson A few plants in drier ground along woodland road behind R.C. Mission farm, Fort Simpson, *8249, 8502, 8833;* only one plant seen in sod along top of river bank, Fort Simpson, *8143;* a single clump at roadside at top of bank overlooking Mackenzie River, Fort Simpson, *8380*.

Rare in the area but certainly to be expected; not previously known along the Mackenzie River between Great Slave Lake (Cody, 1956) and Norman Wells (Cody, 1960).

OXYTROPIS SPLENDENS Dougl. Common on gravel shore, south shore of Mackenzie River at Trout River, 61°18′N 119°51′W, *8514*.

Not previously recorded from along the Mackenzie River between Great Slave Lake and Saline River above Norman (Raup, 1947); recorded by Hooker "From Cumberland House ... to Fort Franklin and the Bear Lake."

HEDYSARUM MACKENZII Rich. forma NIVEUM Boivin Steep gravelly bank of river, Mackenzie River about 23 miles upstream from Fort Simpson, 61°47′N 120°43′W, *8096*.

This white flowered form occurred in a single clump situated among many clumps of the normal red-purple flowered form. The only other place in Mackenzie District from where forma *niveum* has been recorded is from near Coppermine (Cody, 1954b), but it should be expected throughout the range of the species.

GERANIACEAE

GERANIUM BICKNELLII Britton Rare in disturbed ground by Community Centre, Fort Simpson, *8362, 9282;* one plant in garden, Experimental Farm, Fort Simpson, *8437;* rare in disturbed ground along roadside on mainland slope down to Mackenzie River south of Fort Simpson island, *9049*.

This is an extension of range of some 200 miles westward down the Mackenzie River from the site at Hay River on Great Slave Lake (Cody, 1956).

LINACEAE

LINUM USITATISSIMUM L. One plant in oat field by Hudson Bay Co., Fort Simpson, *9236*.

This is a casual introduction of a species that, apparently, has not previously been recorded from Mackenzie District.

CALLITRICHACEAE

CALLITRICHE VERNA L. Common, forming large mats in dried up slough in pasture, Experimental Farm, Fort Simpson, *8740;* same place in shallow water, *8741.*

This species has been recorded from several localities between Great Slave Lake and Eskimo Lake Basin (Porsild, 1943; Raup, 1947; Cody, 1956) but it was apparently previously unknown in the Mackenzie River valley.

ACERACEAE

ACER NEGUNDO L. Beaten shrub 6 ft. high just below top of bank of river by Hudson Bay Co. buildings, Fort Simpson, *8002.*

This male shrub, which had probably been discarded over the bank many years prior to our finding it, although badly beaten, both by the weather and by passers-by, seemed to be maintaining itself well. It was in full flower on June 1. A female shrub in cultivation in front of the Anglican Mission had not set good seed in 1954.

HALORRHAGIDACEAE

MYRIOPHYLLUM VERTICILLATUM L. var PECTINATUM Wallr. Common in shallow water around border of slough near Royal Canadian Corps Signals Transmitters, Fort Simpson, *9018;* in shallow water among moss and *Utricularia vulgaris* in small lake near Royal Canadian Corps Signals Transmitters, Fort Simpson, *8721;* fairly common in shallow water rooted in muck of small slough in bush about 1 mile south of Fort Simpson island, *9110.*

Not previously recorded along the Mackenzie River between Norman Wells (Cody, 1960) and Great Slave Lake (Cody, 1956) although the record in Hooker under *M. spicatum* "as far north as Great Bear Lake" might possibly be referred here at least in part.

ARALIACEAE

ARALIA NUDICAULIS L. Disturbed ground along road through wood, Fort Simpson, *8242;* in sand under open *Populus tremuloides* on mainland about 1 mile south of Fort Simpson island, *9113.*

Recorded by Hooker "... throughout the woody county to lat. 64° ..." but with the exception of a collection from Hay River (Cody, 1956), otherwise unknown in Mackenzie District.

UMBELLIFERAE

SIUM SAUVE Walt. Fairly common in wet moss by bay, Yellowknife, *3515;* fairly common rooted in crevices of rock in 6 inches water, Yellowknife River Power House, 62°40'N 114°15'W, *3297.*

Not previously recorded from east of the Paleozoic boundary in Mackenzie District.

GENTIANACEAE

MENYANTHES TRIFOLIATA L. In wet moss by small slough in bush on mainland about 1 mile south of Fort Simpson island, *9106.*

This is the second collection with accurate locality data from the Mackenzie River (Cody, 1960).

APOCYNACEAE

APOCYNUM ANDROSAEMIFOLIUM L. Scattered on steep sandy open slope of Mackenzie River in thick mat of *Arctostaphylos uva-ursi* and on steep eroding clay schist of slope of Harris Creek opposite Fort Simpson, *8852.*

Although Hooker recorded this species "... throughout the woody country", Raup (1947) reported that he had seen no specimens from north of Great Slave Lake; the northernmost known locality for *A. sibiricum* is also opposite Fort Simpson (Raup, 1947) where I have collected it.

BORAGINACEAE

LAPPULA REDOWSKII (Hornem.) Green var. OCCIDENTALIS (Wats.) Rydb. Scattered along roadside in light sandy soil, Fort Providence, *8538.*

Although recorded by Hooker "Cumberland House to Bear Lake" the only collections with exact locality data are from Fort Smith (Raup, 1947), Fort Simpson (Raup, 1947), Yellowknife (Cody, 1956) and Eskimo Lakes (Porsild, 1943).

HACKELIA AMERICANA (Gray) Fern. Light sandy soil of cleared ground of Indian Village on north shore of Mackenzie River, 61°14'N 119°18'W, *8619;* rare at edge of clearing by Indian cabin overlooking junction of Liard and Mackenzie rivers, Fort Simpson, *8675;* localized in moist black disturbed ground along back road through bush, Fort Simpson, *8496;* scattered in disturbed ground along roadside down slope to Mackenzie River south of Fort Simpson island, *9052.*

Previously known in Mackenzie District only from near the Alberta-Mackenzie border (Cody, 1956).

LABIATAE

DRACOCEPHALUM PARVIFLORUM Nutt. One large plant in garden, Experimental Farm, Fort Simpson, *8443;* very rare in disturbed humus of cleared ground along back road through bush, Fort Simpson, *8358;* one large plant in moist, humus-rich, black ground pushed up by bulldozer at border of field and bush, R.C. Mission Farm, Fort Simpson, *8896.*

The only collections with exact locality data from the Mackenzie River are those collected by Cody (1960) at Norman Wells.

GALEOPSIS TETRAHIT L. var. BIFIDA (Boenn.) Lej. & Court. Rare, a small patch by barn, R.C. Mission Farm, Fort Simpson, *8891.*

Previously known in Mackenzie District from a single collection at Yellowknife (Cody, 1956).

LAMIUM AMPLEXICAULE L. Common in light sandy soil of garden by R.C. school, Fort Providence, *8571.*

An introduced garden weed apparently not previously recorded from north of Fort Saskatchewan, Alta. (Turner, 1949); our collection, which has mature seed, was made on July 4; new to the flora of Mackenzie District.

SCROPHULARIACEAE

VERONICA SCUTELLATA L. Wet disturbed humus by dried up pond behind Community Centre, Fort Simpson, *8365, 8751;* rare in wet black muck by depression in field, Experimental Farm, Fort Simpson, *8309;* dried up depression in pasture, R.C. Mission Farm, Fort Simpson, *8829;* rooted in wet moss and muck in small slough in midst of *Picea glauca* woods behind Anglican Mission, Fort Simpson, *9294.*

Previously unknown below Great Slave Lake (Raup, 1947).

LENTIBULARIACEAE

UTRICULARIA INTERMEDIA Hayne Submerged in 1 ft. or more water among *Carex* and other submergents, fairly common to area, west of Horn River estuary, Mills Lake, Mackenzie River, *H. R. Webster* (DAO).

Recorded by Hooker "Lake Huron to Bear Lake" but otherwise previously unrecorded from the Mackenzie River between Great Slave Lake (Raup, 1936) and Norman Wells (Cody, 1960).

RUBIACEAE

GALIUM TRIFLORUM Michx. A single plant in *Picea, Salix, Alnus* bush behind Experimental Farm, Fort Simpson, *8884;* rare under brush on low bank along back road through bush, Fort Simpson, *8804.*

This is a northwestward extension of range of some 400 miles from Lake Athabaska (Raup, 1936); new to the flora of Mackenzie District.

CAPRIFOLIACEAE

SYMPHORICARPOS OCCIDENTALIS Hook. Shrub 12 to 15 inches, rare on steep eroding clay schist slope of Harris Creek opposite Fort Simpson, *8858.*

Recorded by Hooker "Woody country, between lat. 54° and 64° ...", but the only Mackenzie District specimen recorded to date is one collected by Kennicott at Resolution on the south shore of Great Slave Lake (Raup, 1936, 1947).

COMPOSITAE

SOLIDAGO MULTIRADIATA Ait. Rare in moist sand of cleared ground along road through *Picea mariana* bush about 3 miles southeast of Fort Simpson, *9231.*

Although recorded from the shores of Great Slave Lake (Raup, 1936, 1947) and the Mackenzie River Delta (Raup, 1947), this species has apparently not previously been recorded from the lowlands of the Mackenzie River valley.

SOLIDAGO GIGANTEA Ait. var. SEROTINA (Kuntze) Cronq., *S. gigantea* Ait. var. *leiophylla* Fern. Occasional in cabin clearing at mouth of Martin River about 8 miles downstream from Fort Simpson on Mackenzie River, *8996.*

This is northward extension of range from the Macoun record of *S. serotina* in Raup (1934) "Between Lesser Slave L. and Hudson Hope"; new to the flora of Mackenzie District.

ERIGERON ANGULOSUS Gaudin var. KAMTSCHATICUS (DC.) Hara, *E. acris* L. var. *asteroides* (Andrz.) DC. Rare in waste ground overlooking flats upstream from settlement, Fort Simpson, *8665;* cleared ground by roadside near Royal Canadian Corps Signals Transmitters, Fort Simpson, *8697;* rare in cleared ground near Imperial Oil tanks, Fort Simpson, *8713;* small patch in sand along trail up mainland slope south of Fort Simpson island, *9048;* rare in dry clay

by small stream behind sand hills on south shore of Mackenzie River about 16 miles downstream from Fort Simpson, *8980*.

Although Hooker recorded this plant"... from the Saskatchewan to Fort Franklin on the Mackenzie River," it has apparently not been recorded since for the area between Great Slave Lake and Saline R. above Norman (Raup, 1947).

ERIGERON LONCHOPHYLLUS Hook. Sand gravel beach, Wrigley Harbor, Brabant Island, 61°04'N 116°34'W, *C D. Bird 158* (DAO); fairly common in dry pasture, Experimental Farm, Fort Simpson, *8783;* disturbed ground by road cut through bank at junction of Liard and Mackenzie rivers, Fort Simpson, *8793;* moist clay of disturbed ground along road cut down to Mackenzie River, mainland south of Fort Simpson, *9253;* localized in moist clay by pond behind sand hills on south shore of Mackenzie River about 16 miles downstream from Fort Simpson, *8988*.

Not previously recorded from the area between Great Slave Lake (Cody, 1956) and Norman Wells (Cody, 1960).

ERIGERON ELATUS (Hook.) Greene A few plants in cleared ground by roadside near Royal Canadian Corps Signals Transmitters, Fort Simpson, *8420*.

Raup (1947) cited a Mackenzie River specimen collected by Onion, but without exact locality data; our collection is thus the first with such information from between Great Slave Lake (Raup, 1947, Cody, 1956) and Good Hope (Raup, 1947).

ANTENNARIA PULCHERRIMA (Hook.) Greene Small patch of about a dozen flowering plants in wet sand of cleared ground along road through *Picea mariana* bush about 3 miles southeast of Fort Simpson, *9225*.

Apparently rare in southwest Mackenzie: the only specimen recorded by either Raup (1947) or Porsild (1950) was a Wynne-Edwards collection from Lone Mountain.

GAILLARDIA ARISTATA Pursh Patch 1 ft. in diameter in pasture on R.C. Mission Farm ¼ mile from buildings, Fort Simpson, *8828*.

Apparently introduced in this situation; not previously recorded for Mackenzie District; the nearest record is from Fort Saskatchewan, Alta., where Turner (1949) recorded it "Common on roadsides and in grassy places."

MATRICARIA INODORA L. Rare in light sandy soil of garden by R.C. school, Fort Providence, *8570*.

Our specimens are immature but seem best placed here; previously recorded from Fort Smith and Hay River in Mackenize District (Cody, 1956); see Raup (1947) and Cody (1956) for discussion.

MATRICARIA MATRICARIODES (Less.) Porter Only three plants on cut through Mackenzie River bank in front of Experimental Farm, Fort Simpson, *8369;* one plant in garden, Experimental Farm, Fort Simpson, *8438;* very common around buildings of Goodall farm, Fort Simpson, *8684*.

Introduced; not previously recorded along the Mackenzie River between Great Slave Lake (Cody, 1956) and Norman Wells (Cody, 1960); Mr. Goodall stated that he was probably responsible for the introduction of this species on the island about 1929 because it was not there when he arrived but appeared shortly afterwards; the plant occurs in waste places and along roadsides throughout the settlement.

PETASITES PALMATUS (Ait.) Gray Rare in rich black moist humus in clearing in *Picea mariana* bush on mainland about 2 miles south of Fort Simpson island, *9142*.

Previously recorded for Mackenzie District from only three widely separated localities: Fort Smith, Taltheilei Narrows (Raup, 1936) and Lone Mt. (Raup, 1947).

ARNICA CHAMISSONIS Less var. ANGUSTIFOLIA Herder, *A. chamissonis* ssp. *foliosa* (Nutt.) Maguire Rare in light sandy soil of open ground in townsite, Fort Providence, *8577;* rare on wet flats of Harris Creek opposite Fort Simpson, *8733;* forming large patch in old field behind Hudson Bay Co., Fort Simpson, *8759, 9339*.

Raup (1947) doubtfully referred a single specimen collected by Kennicott labeled 'Mackenzie River' to this entity, but stated that Maguire (Brittonia 4:460-467. 1943) had recorded it [on his map] from two places in southern Mackenzie, one on the south shore of Great Slave Lake and the other along the Mackenzie River near Simpson. It is possible that the Kennicott specimen is the one seen by Maguire, but I have not seen it or the one from the south shore of Great Slave Lake. I do, however, have collections from Fort Smith and the Salt Plains west of Fort Smith, *4208, 4487, 4479*.

According to Maguire (1943, p. 467) the map citation (p. 462, square dot) is ssp. *incana* and is from Fort Simpson. Raup (1947, p. 252) incorrectly attributed this to

ssp. *genuina* and from the position of the dot on the map surmised that the collection came either from Simpson or the Nahanni Mountains. Our No. *8733* is considerably more pubescent than the other collections from the area but the plant showed indications of having been submersed by floods earlier in the season. If this collection could be referred to ssp. *incana*, then that taxon might better be treated as an ecological form.

SENECIO VULGARIS L. Rare in light sandy soil of garden by R.C. school, Fort Providence, *8569*.

Introduced; previously recorded from Mackenzie District from two collections made at Yellowknife in 1949 (Cody, 1956).

SENECIO LUGENS Richards. Clearing near road, Alexandra Falls, Hay River, *W. H. Lewis 436* (DAO); moist place in disturbed wooded muskeg, south of Keg River [Mackenzie Highway], Alta. *E. H. Moss 8336* (DAO); burned muskeg 15 miles north of Meikle River, Mackenzie Highway, Alta., *E. H. Moss 8735* (DAO).

Senecio lugens is an arctic alpine species the range of which extends from Alaska eastwards to Bloody Falls on the Coppermine River (the type locality), southwards through the mountains to Wyoming and Washington. Its occurrence on the lowlands south of Great Slave Lake, some 300 miles east of the nearest previously known stands is therefore most interesting. A map of the distribution as known to Raup in 1947 is given in Sargentia 6.

SENECIO PAUPERCULUS Michx. var FLAVOVIRENS (Rydb.) Boivin, *S. pauperculus sensu* Raup (1947) Rare in light sandy soil by roadside near Royal Canadian Corps Signals bldgs., Fort Providence, *8547;* exposed sandy ledge, common, Brabant Island, Great Slave Lake, *W. H. Lewis 1013*.

Not previously recorded from the area between Lower Slave R. and Nahanni Mt. (Raup, 1947).

SENECIO CONGESTUS (R.Br.) DC., *S. congestus* (R.Br.) DC. var. *palustris* (L.) Fern. Rare in wet moss and muck of small slough in *Salix* bush near Royal Canadian Corps Signals Transmitters, Fort Simpson, *9355*, *9277;* rare in moist humus pushed up by bulldozer at border of field and bush, R.C. Mission Farm, Fort Simpson, *8845;* rare in disturbed ground along roadside on mainland slope down to Mackenzie River, south of Fort Simpson island, *9051*.

Not previously recorded from any exact locality between Norman Wells (Cody, 1960) and Great Slave Lake (Raup, 1936, 1947).

CIRSIUM ARVENSE (L.) Scop. About 200 plants in cleared ground by Royal Canadian Corps Signals Transmitters, Fort Simpson, *8418*, *9013*.

Introduced and apparently becoming well established in this situation; not previously recorded from north of Fort Saskatchewan (Turner, 1949) from where it is recorded as "A common noxious weed of grain fields, roadsides etc."; new to the flora of Mackenzie District.

TARAXACUM DUMETORUM Greene Common in light sandy soil of waste ground near Royal Canadian Corps Signals buildings, Fort Providence, *8529*.

This species was first recorded from Mackenzie District by Raup (1935) from Fort Smith but the specimen upon which the record was based was later (1936) referred by him to *T. ceratophorum*. It is apparently a prairie and parkland species.

TARAXACUM ERYTHROSPERMUM Andrz. Common in open ground of old field behind Hudson Bay Co. buildings, Fort Simpson, *8293*, *8353;* common in sod by roadside downstream from settlement, Fort Simpson, *8233;* moist open sandy pasture south of Fort Smith, *3902*.

Introduced; new to the flora of Mackenzie District; not previously recorded north of Fort Saskatchewan where it is a common weed of roadsides and lawns (Turner, 1949).

TARAXACUM OFFICINALE Weber Most open sandy pasture south of Fort Smith, *3901;* very rare in moist sandy gravel, Mills Lake Camp, south shore of Mackenzie River, *8582;* a common weed in waste ground near Hudson Bay Co. buildings, Fort Simpson, *8352*.

Introduced; the only locality in Mackenzie District from which this species has previously been recorded is Yellowknife (Cody, 1956).

LACTUCA PULCHELLA (Pursh) DC. Very common on bank of Mackenzie River but only occasional in waste ground around buildings of settlement, Fort Providence *8536*.

Not previously recorded from the area between Lower Slave River and Fort Simpson (Raup, 1947), but certainly to be expected there.

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SOME FUNGI FROM SPENCE BAY, BOOTHIA ISTHMUS*

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DURING the week of August 15-22, 1959, in the course of general botanical work at Spence Bay, I collected a number of fungi. Because of the paucity of records of fungi from the Canadian arctic, it seems worth while to present the complete list, although some of the collections have already been noted in a discussion of the botany of Somerset Island (Can. J. Bot. 37:959-1002, 1959). As indicated elsewhere (Can. Field Nat. 73:168-169, 1959), the settlement of Spence Bay straddles the Franklin-Keewatin Boundary. The specimens recorded below were thus all taken within about two miles of the boundary.

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Approximate distances are given from the Hudson's Bay Company post, which is at approximately 69°31'N 93°30'W. The specimens noted as being from north-northeast of the post were generally from the fertile talus and lower ledges of a large cliff, which proved to be a productive site. My collection numbers follow specimen citations.

Mucilago spongiosa (Leyss.) Morg. A large aethalium was found on heath tundra 1 mi. NNE of the H.B.C. post on Aug. 21 (*3901*). This slime mold is recorded from Finland as well as from many more southerly regions, but the present find is perhaps the most northerly record of its occurrence. A plasmodium probably of the same species, just starting to transform into an aethalium, was seen a few days previously, a few miles to the south, but was unfortunately not noticed until it had been severely damaged. The species may, therefore, be not uncommon in the area.

Peronospora parasitica (Pers.) Fr., *s. l.* A localized infection occurred on *Draba lactea* Adams near the H.B.C. post (*3825*). No appreciable distinction could be seen between this collection and material on *Capsella bursa-pastoris*, but it should be noted that *P. drabae* Gäum. and *P. norvegica* Gäum. have been described from *Draba* spp. If this collection were segregated from *P. parasitica* it would have to be placed in *P. norvegica*.

Allophylaria pusiola (Karst.) Nannf. A small amount of this little discomycete was found on dead leaves of *Poa arctica* R. Br., 4 mi. east of the H.B.C. post on the south shore of Middle Lake (*3845A*). There is a specimen in DAOM on the same host from Kenai Peninsula, Alaska. (Det. J. W. Groves.)

Lophodermium arundinaceum (Schrad. ex Fr.) Lév. var. *alpinum* Rehm On old leaves of *Elymus mollis* Trin. ssp. *villosissimus* (Scribn.) Löve, on sandspit 2 mi. NW of H.B.C. post (*3866B*). See discussion in Can. J. Bot. 37:979, 1959.

Lophodermium maculare (Fr.) DeN. A little on dead leaves apparently all of the previous year at the only colony seen of *Vaccinium uliginosum* (*3894*). The host is here evidently at its northern limit, but it reaches Ellesmere I. on the Baffin Bay coast and the fungus is recorded on it from there. The fungus, which is apparently purely saprophytic, seems to occur essentially throughout the range of the host, but it is inconspicuous and is frequently overlooked.

Mycosphaerella vaccinii (Cke.) Schroet. Heavy and at least in part on the first leaves of the current year in the colony of *Vaccinium uliginosum* L. noted under the last species (*3894A*). This fungus seems to be at least weakly parasitic; but it may have been more injurious here, at the limit of the host, than in the body of its geographic range. We have specimens on this host from Red Bay, Labrador; Coral Harbour, and Clyde Inlet. It occurs in the south on *Vaccinium* spp. (See Barr, Contr. Inst. Bot. Univ. Montreal 73:1-101, 1959.)

Pleospora affin. *herbarum* (Pers.) Rab. Occasional on old leaves of *Elymus mollis* Trin. ssp. *villosissimus* (Scribn.) Löve (*3866A*), at the sandspit NW of the settlement. The spores are of the herbarum type, but are somewhat large, 40-48 × 13.5-17. 5μ. It may be noted that Dearness (Rep. Can. arct. Exped., p. 9C, 1923) reported *P. herbarum* on this host from Bernard Harbour. It is also recorded on many hosts from other arctic stations, but several fungi may be involved.

Puccinia arenariae (Schum.) Wint. Heavy in a single colony of *Stellaria monantha* Hult. SE of the H.B.C. post (*3859*). Despite the paucity of published records, we have specimens of this rust taken at or north of treeline on eight hosts from a total of eleven localities. However, the Spence Bay record is the most northerly and it is doubtful whether the species will be found much farther north except in the extreme eastern arctic.

Puccinia bistortae (Strauss) DC. Moderately heavy on *Polygonum viviparum* L. SE of the H.B.C. post (*3857*). Also taken at Spence Bay by J. G. Chillcott in 1951. Recently taken at 74°06'N on Somerset Island, and likely to be found further north on the Baffin Bay coast. Common at low-arctic and subarctic localities.

Puccinia heucherae (Schw.) Diet. var. *saxifragae* (Schlecht.) Savile On *Saxifraga hieracifolia* Waldst. & Kit., south shore of Middle Lake (*3837*). Also taken at Spence Bay by J. G. Chillcott in 1951. Otherwise recorded on this host in Canada only from Prince Charles I.

Puccinia pazschkei Diet. var. *tricuspidatae* Savile Trace near H.B.C. post (*3883*) and heavy on south shore of Middle Lake (*3840*). Widespread at low-arctic and subarctic localities. Occurs sparingly north to 72°50′N on Somerset Island.

Puccinia fischeri Cruchet & Mayor On *Saxifraga oppositifolia* L. near H.B.C. post (*3891*) and north of post (*3879*). See discussion in Can. J. Bot. 38:980, 1950.

Puccinia helicalis Savile On *Pedicularis capitata* Adams NNE (*3899*) and south (*3858*) of H.B.C. post. See Can. J. Bot. 37:981, 1959, for description and discussion. Known otherwise only from Somerset Island and Cold Bay, Alaska, and since found sparingly at Coral Harbour, Southampton Island.

Uromyces lapponicus Lagh. The systemic aecia were found on *Oxytropis maydelliana* Trautv. NNE of the H.B.C. post (*3900*). Despite the late date (Aug. 21), no telia could be found. With one minor exception I have never found them north of treeline, and have found them with difficulty a considerable distance south of it. The exception was the finding in a 1959 collection, on *Astragalus richardsonii* Sheldon from Cambridge Bay, of a few telia on dead leaves of 1958. The teliospores were somewhat immature, despite 1958 being an unusually favorable year at Cambridge Bay and many other parts of the arctic, and none had germinated. It is therefore questionable whether the telia ever function in the arctic. It is possible that the aecia occasionally repeat, as in *Cronartium* and *Melampsorella;* but it must be remembered that plants bearing aecia remain infected perennially, and spread of the rust is possible even if telia are formed only once in about ten years. This collection and one on *Phaca frigida* L. from Herschel Island are apparently the most northerly ones known; but Spence Bay is much farther beyond treeline than Herschel Island.

Ustilago bistortarum (DC.) Körn. Locally abundant on *Polygonum viviparum* L. NNE of the H.B.C. post (*3895*). Occurs north to the limit of land but seldom abundant.

Ustilago vinosa (Berk.) Tul. Abundant in a single colony near the base o fa cliff NNE of the H.B.C. post on *Oxyria digyna* (L.) Hill (*3905*). Recorded north to Prince Patrick Island.

Ustilago violacea (Pers.) Roussel var. *violacea* A few infected plants of *Lychnis apetala* L. var. *arctica* (Fries) Cody were found near the H.B.C. post (*3826*). Very common on this host on Somerset Island, and its apparent scarcity at Spence Bay perhaps due to most infected plants having shriveled. Occurs north at least to 80°00′N on Ellesmere I. on *L. sorensenis* Boivin.

Exobasidium vaccinii Wor. Abundant in a single colony of *Cassiope tetragona* (L.) D. Don on the richly vegetated talus of a cliff NNE of the H.B.C. post (*3897*). Reported sparingly on this host north to Pond Inlet in the eastern arctic and Four Rivers Bay on Somerset Island.

Arcticomyces warmingii (Rostr.) Savile Despite the fruiting period for this fungus being largely over, a trace was found on *Saxifraga oppositifolia* L. near the H.B.C. post (*3880*). See discussion in Can. J. Bot. 37:984, 1959.

Asteromella picbaueri Petrak Locally abundant on *Astragalus alpinus* L. NNE of the H.B.C. post (*3898*). The pycnidia were conspicuous in the very pale infected leaflets. The spores and the systemic habit agree well with Petrak's Myc. Gen. 205, although the latter specimen, on *A. cicer* L., has more erumpent and more crowded pycnidia. I can find no prior record of this fungus in North America.

Bostrichonema alpestre Ces. A trace was seen on *Polygonum viviparum* L. east of the H.B.C. post (*3852*). Extensive searches on Somerset Island failed to reveal it and Spence Bay seems to be approximately its northern limit at least in the central part of the arctic. It is represented in DAOM from ten low arctic, subarctic or alpine situations from coast to coast.

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SEA-BIRD COLONIES OF PRINCE LEOPOLD ISLAND AND VICINITY

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DURING part of July and August 1958 I was at Somerset Island, Northwest Territories, in company with the J. Brian Bird expedition. Using a Beaver aircraft I was able to conduct aerial reconnaissance of wildlife on Somerset and adjacent islands. On July 28 and 29 I visited Limestone Island off the northwest coast of Somerset and Prince Leopold Island (74° N 90°W), eight miles northeast of Cape Clarence, Somerset Island.

On these flights concentrations of the following birds were noted at various points: Fulmar (*Fulmarus glacialis*), Glaucous Gull (*Larus hyperboreus*), Thayer's Gull (*Larus argentatus thayeri*), Black-legged Kittiwake (*Rissa tridactyla*), Thick-billed Murre (*Uria lomvia*), and Black Guillemot (*Cepphus grylle*). I returned to Prince Leopold on August 13, remaining until August 19, when we continued flights along part of the south coast of Devon Island, and up Admiralty Inlet on Baffin Island before returning to base camp near Bellot Strait on Somerset.

The shores of Prince Leopold are sheer limestone cliffs rising to about 1,200 feet at the highest point and having talus slopes on the south and west sides. The nesting cliffs were for the most part inaccessible without the use of climbing ropes. Chips of the friable limestone continually rattled down the face of the cliffs. An occasional large rockfall frightened flocks of birds from its path. On a narrow beach below the south end of the east cliff I found remains of about 50 murres and kittiwakes undoubtedly killed by a recent rockfall. While on this beach I witnessed a fall that killed six murres and a kittiwake.

Strong currents flowing eastward from Barrow Strait and westward from Lancaster Sound converge at Leopold Island before sweeping down Prince Regent Inlet. These currents, ice, and high tides prevent beach formation and talus accumulation under the north and east cliffs, where most of the sea birds nested. In fact, the northeast cliff, highest on the island, is noticeably undercut. Apparently, the converging currents also carry a concentration of food for the seabirds in the vicinity.

Limestone Island is similar to Leopold, although it is only about 500 feet high and the currents and tides seem to be less strong.

Since most of the nesting cliffs were inaccessible, except for glimpses from the rim, across fluting, or from the airplane, population figures are at best rough estimates or guesses.

OBSERVATION NOTES

FULMAR. Nested on upper reaches of the cliffs almost continuously around Leopold Island. Many were seen near the Cape Clarence cliffs, and they probably nest there also. Fulmars were also scattered along the north coast of Somerset Island and around Limestone Island where possibly they nest.

There was another concentration of Fulmars in Lancaster Sound and in Admiralty Inlet, probably from the nearest known Fulmar colony at Baillarge Bay. I estimate the population at Leopold Island and Cape Clarence at about 150,000. Light-phase birds were more abundant than dark-phase.

PARASITIC JAEGER (*Stercorarius parasiticus*). Two nests of mixed dark-phase and light-phase pairs were on Leopold's southeast spit. About 40 or 50 others, probably mostly transients, were in the area. I did not see jaegers preying upon other birds, but noticed that they picked over remains of accident victims along the shore.

GLAUCOUS GULL. At Leopold about 2,000 nested on the wider ledges and along the ravines; most were scattered along the rim and chimneys above the murre and kittiwake colonies. They took eggs and young of other birds, but more commonly fed on carcasses on the beach.

THAYER'S GULL. None were seen on Leopold, but nesting groups were found on Somerset Island at Bellot Strait; north of Fury Beach; north of Batty Bay, south of Limestone Island; and at Fitz Roy Inlet. They totaled 600 to 1,000.

BLACK-LEGGED KITTIWAKE. At Leopold these nested in close association with murres but usually in patches dominated by one or the other species. In a few areas where suitable ledges were available near the rim, murres and kittiwakes were found with fulmars. At very regular intervals flocks of 200 to 300 kittiwakes flew from the cliffs, crossed the base of the spit to the outlet of the south-flowing ravine. There they would feed and splash, then move together onto the beach to preen before returning to the cliffs as another group arrived. Their traditional flight path is marked by an abundance of orange lichens fertilized by their droppings. (Murres seldom crossed the spit, but flew around it instead.) I noted a similar routine at the stream outlet on the north point and at a fresh-water pool on top near the east cliffs. Kittiwakes, and murres to some extent, crowded onto ice chunks floating past the gravel spit in the 5-knot current.

About 100,000 to 180,000 kittiwakes nested on Leopold Island. Mr. L. M. Tuck reports that about 50,000 kittiwakes nested at Cape Hay, Bylot Island, but in early June 1957 at least 200,000 appeared in that vicinity for a few days; it is possible that many of those kittiwakes continued on to Leopold Island to nest. Some may also nest on Limestone Island and perhaps at Cape Clarence.

THICK-BILLED MURRE. Probably more than 350,000 nest at Leopold Island on the east and north cliffs. Numbers of murres in the water near Limestone Island indicate that they nest there also. First young were seen leaving the cliffs at Leopold Aug. 15.

BLACK GUILLEMOT. About 4,000 nested among the talus and fractured chimneys and columns at Leopold. A considerable number were also seen in the vicinity of Limestone Island where they probably nest.

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MALAXIS PALUDOSA (L.) SW. IN THE HUDSON BAY LOWLANDS

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While engaged on a Museum survey of the plants of this peatland wilderness, I found a new, isolated station of the extremely rare bog adder's-mouth. This discovery prompted a review of the occurrence and distribution of this orchid in North America particularly and throughout its range. Besides rarity, this species has phytogeographical interest and a curious habitat preference. Further details on these points may encourage Canadian naturalists to search for this plant and so fill in certain gaps in our knowledge.

The writer already had field experience with the two other *Malaxis* species of northeastern America, *M. brachypoda* (Gray) Fern. and *M. unifolia* Michx., at the northern limit of their ranges in the Clay Belt of Quebec (Baldwin, 1958). But *M. paludosa* was neither expected nor recognized in the field and the plants were placed with depauperate specimens in a large package of the more common orchids. Dr. A. E. Porsild, however, immediately recognized it when the Hudson Bay Lowlands collection was being reviewed. This specimen was labeled:

Ontario. 18 miles east-southeast of Ogoki Hudson's Bay Company post, near Wabimeig Lake; floating mat on small lake (lat. 51°31½'N., long. 85° 33½'W.). Baldwin No. 6782, Aug. 12, 1956, (CAN).

Two plants were found in sphagnum on the floating mat shown in the center of the photograph (Figure 1). The mat was composed of sphagnum, sedges and ericaceous shrubs with some clumps of *Salix pedicellaris* Pursh var. *hypoglauca* Fern., *Betula pumila* L. var. *grandulifera* Regel and *Picea mariana* (Mill.) BSP. The foreground of the picture shows a zone of *Iris versicolor* L. and the edge of a black spruce woods that fringes the lakeshore. A closed, boggy forest of black spruce with a few scattered tamaracks (*Larix laricina* (DuRoi) K. Koch) can be seen in the background. Besides the species mentioned above, the following were collected close to the orchids on the floating mat: *Kalmia polifolia* Wang., *Hypericum virginicum* L. var. *Fraseri* (Spach) Fern. (Nos. 6776 and 6778 being the first records of this species in the Hudson Bay Lowlands), *Juncus stygius* L. var. *americanus* Buchenau (No. 6779, another addition to the flora of the region and but rarely collected in Ontario), *Eriophorum tenellum* Nutt. (No. 6780, a considerable extension of range north from the Clay Belt), *Drosera rotundifolia* L., *Scheuchzeria palustris* L. var. *americana* Fern., *Lycopus uniflorus* Michx., *Epilobium leptophyllum* Raf. (No. 6785, another addition to the regional flora.)

The foregoing assemblage of plants evidently differed in some elements from the ordinary composition of floating bogs in this great peatland. The lake on which it floated is situated between an extensive series of string bogs and the shallow Wabimeig Lake, which is one of the biggest of the few large lakes in the region. Surrounding the lake were low, boggy black spruce forest and woods in a wide, open bog and fen land. Perhaps the occurrence of

FIGURE 1. Habitat of *Malaxis paludosa* on floating mat off peaty shore of isolated lake in the vast mire of the Hudson Bay Lowlands.

eutrophic species in this community may be due to local frost heaving, which could have brought calcareous materials up from the underlying clays that mantle the Paleozoic bedrock, in the manner described by Sjörs (1959, p. 13).

The principal range of *Malaxis paludosa* (*Hammarbya paludosa* (L.) O. Kuntze) is in central and northern Europe (Clapham, Tutin and Warburg, 1952). It is the only species of the genus in the British Isles where it usually occurs in wet sphagnum also. The earliest collection from North America was: Alaska, Back Bay, borders of beaver ponds, M. W. Gorman No. 127, July 28, 1895. "Very rare in this region. Only found nine specimens" (US). D. S. Correll noted on the sheet in Washington that two of the three plants thereon are not *Malaxis*. In a letter (1910) to John Macoun preserved with the first Canadian specimen (CAN), Henry C. Cowles wrote that he had found several specimens in a sphagnum bog at Ketchikan, Alaska, in 1907. Hultén (1942) listed two more stations found subsequently in the Alaska panhandle: Wrangell, bog, William S. Cooper, Aug. 17, 1916 (US); and Juneau, muskeg, J. P. Anderson, July 7, 1940 (CAN).

According to Correll (1950) the first U.S.A. collection was from northern Minnesota by Dr. H. L. Lyon about 1905. Correll listed three counties (Clearwater, Itasco and Otter Tail) having stations. Previously Rydberg (1932) noted only the Otter Tail locality and added "adventive from Europe." The correctness of the latter comment may be doubted in the light of the later

discoveries. Certainly the species would not have been introduced to our remote station in the difficult mire country of the Hudson Bay Lowlands.

The first Canadian collection was: Ontario, Silver Islet, Port Arthur, muskeg; Henry C. Cowles, August 1909 (on envelope containing one plant) "found at the edge of a sphagnum bog not far from the Lion Rock and Lake Superior near Silver Islet, which lies a bit to the east of Thunder Cape" (from accompanying letter to Macoun) (CAN). This discovery on the Sibley Peninsula, Thunder Bay District, stimulated a successful search by Morris and Eames who gave a charming account of their hunt and two fine photographs in *Our Wild Orchids* (1929). They noted that the preferred habitat of more than fifty plants was "rich, moist and nearly always open" – "soft bog-turf to loose sphagnum": Thunder Cape, spruce bog, F. J. A. Morris, July 31–Aug. 6, 1926 (CAN). A brief note by Allin (1940) reported a third locality in the Sibley Peninsula about 20 miles north of the previous ones: near Pass Lake collected by Col. Milton Francis, July 29, 1939. The latest record from the same lakehead area was made on Silver Islet, just off the Peninsula by C. E. Garton and H. K. Campbell, No. 1297, Aug. 23, 1950 (DAO). The new Hudson Bay Lowland station is about 260 miles northeast of the Sibley Peninsula localities.

According to Szczawinski (1959) the first collection for British Columbia was from north of the Cariboo Mountains: Aleza Lake, B. G. Griffith, July 15, 1932 (CAN). It has been collected also on the B.C. coast at Prince Rupert by J. A. Calder, D. B. O. Savile and J. M. Ferguson, No. 13207, July 18, 1954 (DAO) and on the Queen Charlotte Islands by Calder, Savile and R. L. Taylor, No. 23184, 23482, 23665, and 22700 (DAO) in 1957. The latter collections are remarkable for the quantity of fine specimens. These B.C. collections and the field experience of Morris and Eames at Sibley suggest that our orchid may have been much overlooked, that it is probably more frequent and abundant than previously supposed, and that the great gaps between the Minnesota, Ontario, B.C. and Alaska stations will possibly be closed by future collectors.

Hultén (1958) notes that *Malaxis paludosa* is not very variable over its range and that it is rare also in much of its principal area. In his classification *M. paludosa* belongs to a group of boreal species of more or less circumpolar plants with very disrupted ranges, or reported as amphiatlantic. In his map the Eurasian range shows a scattering of stations eastward from the main European area across Russia to Japan.

In Canada, Victorin (1935) suggested that it might be found in the Laurentian flora of Quebec. Moss (1959) listed it in his *Flora of Alberta* (which lacks citation of specimens) noting it as rare. Although small and inconspicuous there is no other boreal North American orchid in the same habitat that would be confused with it. The swollen bases of the stems (pseudobulbs) are good field marks outside the distinctive flowering period. The chief need is to put naturalists on the alert for it.

The writer gratefully acknowledges the help of Mr. F. N. Cowell of Timmins, Ontario, in the field, and of Dr. A. E. Porsild at the National Herbarium of Canada.

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A COLLECTION OF PLANTS FROM THE HORN PLATEAU, DISTRICT OF MACKENZIE, NORTHWEST TERRITORIES

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DURING the 1959 Northern Great Plains Botanical Field Trip sponsored by Chicago Natural History Museum, a brief time (July 31 - August 2) was spent on the Horn Plateau in southwestern District of Mackenzie. The observations and collections made there are the subject of this report. These collections are the first ever taken from the plateau and are, so far as I have been able to determine, the first from the area bounded by Great Slave Lake on the east and the Mackenzie River on the south and west (with the exception of some of my collections from the Mackenzie River – Fort Rae Highway northeast of Fort Providence).

Horn Plateau, called also Horn Mountain(s), rises from the Mackenzie Lowlands to an altitude of 2300 to 2600 feet. The summit is about 1600 to 1900 feet above the surrounding terrain. The plateau extends about 75 miles in an east-west direction. Its greatest north-south extent is about 35 miles. The eastern tip of the plateau is some 48 miles north of Mills Lake; the western tip, some 32 miles east-northeast of Fort Simpson.

Horn Plateau and several similar plateaus to the south and east (including the Cameron Hills and Caribou Mountains) are thought to have been formed through long-continued dissection of the uplifted strata of Cretaceous age that covered the whole region (Raup, 1935). These strata underlie the plateau and on the scarp are exposed along several small streams as "dark grey, fissle shales slightly rusty weathering and sulphur stained, with scattered selenite

crystals" (Douglas, 1959). The plateau is heavily drift covered (Whittaker, 1922). Surface soil atop the plateau is gray, slightly calcareous, and clayey, presumably derived from boulder till.

Geological parties visited the western and eastern tips of the plateau in 1921 and 1922. The accounts of the ascents are well worth repeating here. Of the western end, Whittaker (1923) wrote:

> Horn mountain in this area rises rather abruptly from this level plain [Mackenzie Lowlands] to a height of about 1500 feet. This ascent is made in a gentle slope of about 300 feet in half a mile and an abrupt rise of 1200 feet in about 300 yards. From the crest the land rises very slowly for about a mile, then merges into the plateau which forms the top of the mountain. The plateau at this point is covered with stunted spruce and, more rarely, poplar.

Whittaker's (1922) account of the eastern end of the plateau is as follows:

> Rising to a height of 2000 feet from the monotonous plain of muskeg and lake, Horn Mountain range roughly parallels the Mackenzie and disappears opposite Simpson. These hills rise gradually to a height of about 1200 feet above the plain in a distance of about 6 miles. At this height the slope is truncated by a level strip averaging 1½ miles wide, and then follows an abrupt rise of 400 to 500 feet to the top of the range, which is a plateau . . ., almost treeless, covered with caribou moss, and dotted with small ponds. One of these ponds is worthy of being called a lake, being about 1½ miles long by ¾ mile wide.... The trees on the bare plateau of the range show plainly the effects of the prevailing winds. The limbs all point to the southeast, and the northwest sides of the trees are scarred and limbless.

Our visit to the plateau was to its eastern tip in the vicinity of Lake-on-the-Mountain (62° 08′ N 118° 07′ W), the pond that Whittaker considered worthy of being called a lake. Our reconnaissance was carried out from the southeast shore of the lake to the edges of the plateau south and east of the lake.

Lake-on-the-Mountain is at an elevation of about 2330 feet and is one mile long and half a mile wide (slightly smaller than Whittaker's estimate). Its bank, at least on the southeast shore, is five to six feet high, steep, and bouldery. Boulders line the shore and also cover the bottom as far out (two to three feet) as we could see in the rather turbid water. The depth of the water increases quite rapidly. Our float-equipped plane was able to approach within one or two feet from the shore before striking submerged boulders.

The steep, bouldery southeast bank of the lake is covered with a thicket made up of *Salix glauca*, *Alnus crispa*, *Betula glandulosa*, and *B. occidentalis*. Similar thickets are found along the streams flowing down the south slope of the plateau. Undergrowth in these thickets is very scanty and includes *Artemisia tilesii*, *Chrysosplenium tetrandrum*, *Galium trifidum*, *Ledum groenlandicum*, *Lycopodium annotinum*, *Peltigera aphthosa*, and *Petasites frigidus palmatus*. *Ledum groenlandicum* becomes especially abundant at the upper edge of the thicket along the southeast shore of the lake, forming, in many places, a distinct zone between the thicket and the tundra on the level land above the lake.

Except for some floating fragments of a broad-leaved *Potamogeton*, no submerged aquatics were seen along the southeast shore. The bouldery bottom and the depth of the water here are unfavorable for such plants. Among boulders at the water's edge are occasional clumps of *Calamagrostis canadensis*, *Carex aquatilis*, and *Potentilla palustris*.

Much of the summit of the plateau in the vicinity of Lake-on-the-Mountain is covered with lichen tundra in which common or frequent lichens are *Alectaria ochroleuca*, *Cetraria cucullata*, *C. nivalis*, *Cladonia alpestris*, *C. amaurocraea*, *C. cornuta*, and *C. rangiferina*. The lichens form a more or less continuous cover in which other plants are rather scattered. The most common flowering plants in the tundra are *Ledum decumbens* and *Vaccinium vitis-ideaea*. *Rubus chamaemorus* is frequent. Less common shrubs are *Andromeda polifolia*, *Betula glandulosa*, *Empetrum nigrum*, and *Salix glauca*. None of the shrubs is over two feet tall. Herbaceous flowering plants are few. Of these, *Arctagrostis latifolia* and *Pedicularis labradorica* are the most frequently seen.

Here and there in the tundra are small areas of stony, frost-disturbed soil that are bare of vegetation except for *Juncus castaneus*, *Luzula multiflora frigida contracta*, and *Stellaria longipes*, and scattered lichens, including *Cladonia alpicola*, *C. coccifera*, *Coriscium viride*, and *Icmadophila ericetorum*.

Lines of drainage and small moist depressions in the tundra are characterized by the local abundance of *Sphagnum*. *Sphagnum capillaceum*, *S. lindbergii microphyllum*, *S. squarrosum*, and *S. teres* were collected in these situations. Larger moist areas, which might be called "marshy," usually have a basic ground cover of mosses, the most apparent of which are *Aulacomnium palustre* and *Sphagnum*. The grasses and sedges *Arctophila fulva*, *Calamagrostis canadensis*, *C. neglecta*, *Eriophorum angustifolium*, and a rhizomatous *Carex*, unfortunately sterile at the time of our visit, may be frequent to abundant locally. The only trees in these marshy areas are a few scattered black spruces. Shrubs observed are *Andromeda polifolia*, *Arctostaphylos rubra*, *Betula glandulosa*, *Empetrum nigrum*, *Potentilla fruticosa*, *Rubus chamaemorus*, *Salix reticulata*, *Vaccinium vitis-idaea*, and *V. uliginosum*. Herbs include *Castilleja raupii*, *Parnassia multiseta*, *Pedicularis labradorica*, *Potentilla palustris*, *Senecio lugens*, and *Tofieldia pusilla*.

In depressions above the southeast shore of the lake are found picturesque, stunted black spruces. Maximum height of these trees is about 15 feet, but most of them are smaller, and some are even prostrate. Their branches typically point toward the southeast, away from the direction of prevailing winds.

On higher ground about half a mile east of the lake is a fairly typical forest of black spruce and feather moss (*Hylocomium splendens—Ptilium crista-castrense*) with a rather sparse shrubby and herbaceous flora including *Anemone parviflora*, *Corallorhiza trifida*, *Habenaria obtusata*, *Kalmia polifolia*, *Potentilla fruticosa*, *Salix myrtillifolia*, and *Tofieldia pusilla*. A few white spruces were seen in this forest.

South- and east-facing slopes just below the summit of the plateau show clearly the results of fire. Numerous blackened dead trees are to be seen. The east-facing slope is dominated by young black spruces, *Betula glandulosa*, *Alnus crispa*, and *Salix glauca*. A few young white spruces also occur. Most of the shrubs are less than six feet tall, but the trees reach 15 or 20 feet. *Hylocomium splendens* is the most common ground cover; it occurs in scattered patches between which is rocky soil with but a few other plants, including *Arctostaphylos rubra*, *Arnica lonchophylla*, *Epilobium angustifolium*, *Em-*

petrum nigrum, *Geocaulon lividum*, *Ledum decumbens*, *L. groenlandicum*, *Potentilla fruticosa*, *Rhododendron lapponicum*, *Pyrola grandiflora*, *Senecio lugens*, *Solidago multiradiata*, *Tofieldia pusilla*, and *Vaccinium vitis-idaea*. The south-facing slope has similar plant cover except that white spruce replaces black spruce almost entirely and *Hylocomium splendens* is much less common.

CATALOGUE OF PLANTS

In the following catalogue of plant specimens collected at Lake-on-the-Mountain, entries are arranged in three major groups, as follows: Lichenes, 14 species; Bryophyta, 15 species; and Tracheophyta, 78 species. Lichenes are arranged alphabetically by genus and species; and Bryophyta, alphabetically by class, genus, and species. The families of Tracheophyta are arranged according to the Englerian system, but the genera and species within the families appear in alphabetical order.

To conserve space, five terms are used to define localities from which many specimens were collected. The terms and their meanings are as follows:

tundra – lichen tundra atop plateau south of lake;

bank thicket – thicket dominated by *Alnus*, *Betula*, and *Salix*, on steep, bouldery bank above southeast shore of lake;

east slope – east-facing slope dominated by *Picea*, *Alnus*, *Betula*, and *Salix*, below summit of plateau east of lake;

south slope – south-facing slope dominated by *Picea*, *Alnus*, and *Betula*, just below summit of plateau south of lake;

marsh – marshy areas southeast of lake.

All specimens cited here are in the herbarium of Chicago Natural History Museum (F). Collection numbers are those of the author and his field assistant, Robert J. Reich.

LICHENES

Alectaria ochroleuca (Ehrh.) Ach. Frequent, tundra, *5910*.

Cetraria cucullata (Bell.) Ach. Common, tundra, *5912, 6299*.

Cetraria nivalis (L.) Ach. Frequent, tundra, *5917*.

Cetraria pinastri (Scop.) Hoffm. On branches of black spruce near southeast shore of lake, *6300*.

Cladonia alpestris (L.) Rabh. Common, tundra, *5911*.

Cladonia alpicola (Fw.) Vainio. Infrequent in stony, frost-disturbed soil, tundra, *5916c*.

Cladonia amaurocraea (Flk.) Schaer. Frequent, tundra, *5913*.

Cladonia coccifera (L.) Willd. Frequent in stony, frost-disturbed soil, tundra, *5916b, 6298*.

Cladonia cornuta (L.) Schaer. Frequent, tundra, *5918*.

Cladonia deformis (L.) Hoffm. Frequent, tundra, *5916*.

Cladonia rangiferina (L.) Web. Common, tundra, *5914*.

Coriscium viride (Ach.) Vainio. Rare in stony, frost-disturbed soil, tundra, *6297*.

Icmadophila ericetorum (L.) Zahlbr. Infrequent in stony, frost-disturbed soil, tundra, *6301*.

Peltigera aphthosa (L.) Willd. Infrequent, bank thicket, *5915*.

BRYOPHYTA

Hepaticae

Cladopodiella fluitans (Nees) Buch. Common in shallow pool, tundra, *6289*.

Musci

Aulacomnium palustre (Hedw.) Schwaegr. Common marsh, *5894*.

Ceratodon purpureus (Hedw.) Brid. Among boulders at southeast shore of lake, *6290*.

Dicranum bergeri Bland. Infrequent, tundra, *6291*.

Dicranum elongatum Schleich. Rare, tundra, *6296*.

Drepanocladus uncinatus (Hedw.) Warnst. Infrequent among boulders at southeast shore of lake, *5901;* infrequent, bank thicket, *6295.*

Hylocomium splendens (Hedw.) Bry. Eur. Frequent, east slope, *5832.*

Leptobryum pyriforme (Hedw.) Schimp. Among boulders at southeast shore of lake, *6292.*

Polytrichum strictum Banks. Infrequent, tundra, *5931.*

Ptilium crista-castrense (Hedw.) Nees. Rare, tundra, *6293;* rare among boulders at southeast shore of lake, *6294.*

Sphagnum capillaceum (Weiss) Schrank. Infrequent, marsh, *5895.*

Sphagnum lindbergii Schimp. var. *microphyllum* Warnst. Occasional to common, wetter areas, tundra, *5854.*

Sphagnum squarrosum Crome. Edge of small pool, tundra, *5922.*

Sphagnum teres Angstr. Frequent, marsh, *5902.*

Splachnum luteum Hedw. Rare, tundra, *5933.*

TRACHEOPHYTA

EQUISETACEAE

Equisetum arvense L. Infrequent, south slope, *5883a.*

Equisetum pratense Ehrh. Infrequent, south slope, *5883.*

Equisetum scirpoides Michx. Rare, east slope, *5834.*

Equisetum sylvaticum L. Frequent in *Sphagnum* among black spruce above southeast shore of lake, *5855.*

LYCOPODIACEAE

Lycopodium annotinum L. Rare, bank thicket, *5899.*

Lycopodium complanatum L. Rare, south slope, *5873.*

PINACEAE

Juniperus communis L. var. *depressa* Pursh. Rare, east slope, *5837.*

Picea glauca (Moench) Voss. Infrequent, east slope, *5819a.*

Picea mariana (Mill.) BSP. Common in depressions at southeast shore of lake, *5860.*

GRAMINEAE

Agrostis scabra Willd. forma *tuckermanii* Fern. Infrequent, south slope, *5878.*

Arctagrostis latifolia (R. Br.) Griseb. Infrequent, tundra, *5920;* infrequent, marsh, *5890;* infrequent, east slope, *5830.*

Arctophila fulva (Trin.) Rupr. Locally common, marsh, *5904.*

Calamagrostis canadensis (Michx.) Nutt. (approaching var. *robusta* Vasey) Infrequent, marsh, *5891, 5905;* infrequent, bank thicket, *5900.*

Calamagrostis neglecta (Ehrh.) Gaertn., Mey., et Scherb. Rare, tundra, *5857, 5921.*

Poa pratensis L. s.l. Infrequent, south slope, *5866;* rare, tundra, *5934.*

Trisetum spicatum (L.) Richt. var. *maidenii* (Gand.) Fern. Rare, south slope, *5863.*

CYPERACEAE

Carex aquatilis Wahl. Infrequent in mud among boulders, southeast shore of lake, *5907.*

Carex capitata L. Infrequent, east slope, *5842.*

Carex limosa L. Infrequent, marsh, *5852.*

Carex media R. Br. Infrequent, marsh, *5889.*

Carex scirpoidea Michx. Infrequent, east slope, *5817.*

Eriophorum angustifolium Honck. Infrequent to common, marsh, *5906.*

Eriophorum vaginatum L. ssp. *spissum* (Fern.) Hult. Infrequent, tundra, *5908.*

JUNCACEAE

Juncus castaneus Smith. Rare in stony, frost-disturbed soil, tundra, *5856.*

Luzula multiflora (Retz.) Lej. ssp. *frigida* (Buch.) Krecz. var. *contracta* Sam. Rare in stony, frost-disturbed soil, tundra, *5858;* rare, east slope, *5843.*

LILIACEAE

Tofieldia pusilla (Michx.) Pers. Rare, east slope, *5831.*

ORCHIDACEAE

Corallorhiza trifida Chat. Rare, black spruce forest east of lake, *5807.*

Habenaria obtusata (Pursh) Rich. Infrequent, black spruce forest east of lake, *5804.*

SALICACEAE

Populus balsamifera L. Infrequent, south slope, *5880.*

Populus tremuloides Michx. Infrequent, south slope, *5881.*

Salix glauca L. Common, bank thicket, *5927;* infrequent, marsh, *5802;* infrequent, tundra, *5859, 5932;* common, east slope, *5810;* infrequent, south slope, *5867.*

Salix myrtillifolia Anders. Infrequent, black spruce forest east of lake, *5806.*

Salix reticulata L. Infrequent, marsh, *5801;* rare, east slope, *5818.*

BETULACEAE

Alnus crispa (Ait.) Pursh. Common, east slope, *5815*; common, south slope, *5876*; common, bank thicket, *5926*.

Betula glandulosa Michx. Common, east slope, *5811*; common, south slope, *5868*; scattered, tundra, *5845*; common, bank thicket, *5928*.

Betula occidentalis Hook. Common, bank thicket, *5930*.

SANTALACEAE

Geocaulon lividum (Rich.) Fern. Rare, east slope, *5834*.

POLYGONACEAE

Polygonum viviparum L. Infrequent, east slope, *5841*; rare, marsh, *5893*.

CARYOPHYLLACEAE

Arenaria lateriflora L. Rare, south slope, *5882*.

Stellaria longipes Goldie. Rare in stony, frost-disturbed soil, tundra, *5935*.

SAXIFRAGACEAE

Chrysosplenium tetrandrum (Lund) Fries. Rare, bank thicket, *5897*.

Mitella nuda L. Rare, east slope, *5825*.

Parnassia multiseta (Ledeb.) Fern. Rare, east slope, *5809*.

ROSACEAE

Potentilla fruticosa L. Infrequent, east slope, *5812*.

Potentilla palustris (L.) Scop. Rare, marsh, *5903*; rare among boulders, southeast shore of lake, *5923*.

Rosa acicularis Lindl. Rare, south slope, *5874*; rare, tundra, *5861*.

Rubus chamaemorus L. Scattered to frequent, tundra, *5847*.

Rubus idaeus L. var. *strigosus* (Michx.) Maxim. Rare, *Alnus-Betula-Salix* thicket along creek on south slope of plateau just below summit, south of lake, *5886*.

EMPETRACEAE

Empetrum nigrum L. Infrequent, east slope, *5819*; rare, south slope, *5871*; infrequent, tundra, *5844*.

ELAEAGNACEAE

Shepherdia canadensis (L.) Nutt. Infrequent, east slope, *5836*.

ONAGRACEAE

Epilobium angustifolium L. Infrequent, east slope, *5829*; rare, south slope, *5887*.

Epilobium palustre L. var. *oliganthum* (Michx.) Fern. Rare, marsh, *5800*.

CORNACEAE

Cornus canadensis L. Infrequent, south slope, *5872*.

PYROLACEAE

Pyrola grandiflora Radius. Rare, east slope, *5826*.

ERICACEAE

Andromeda polifolia L. Infrequent, tundra, *5850*; rare, east slope, *5840*.

Arctostaphylos rubra (Rehd. et Wils.) Fern. Infrequent, east slope, *5817*.

Kalmia polifolia Wang. Rare, spruce forest east of lake, *5805*.

Ledum decumbens (Ait.) Lodd. Common, tundra, *5846*; infrequent, east slope, *5813*.

Ledum groenlandicum Oeder. Infrequent, east slope, *5814*; rare, marsh, *5896*; frequent to common, bank thicket, *5924*.

Rhododendron lapponicum (L.) Wahl. Infrequent, east slope, *5827*; rare, sedge-dominated area southeast of lake, *5803*.

Vaccinium oxycoccos L. Infrequent on *Sphagnum* among black spruce above southeast shore of lake, *5853*.

Vaccinium uliginosum L. Rare, bank thicket, *5925*; infrequent, tundra, *5919*; infrequent, east slope, *5822*.

Vaccinium vitis-idaea L. var. *minus* Lodd. Common, tundra, *5848*; infrequent, east slope, *5824*; infrequent, south slope, *5879*.

GENTIANACEAE

Gentianella amarella (L.) Börn. ssp. *acuta* (Michx.) Gillett. Infrequent, east slope, *5808*.

SCROPHULARIACEAE

Castilleja raupii Penn. Infrequent, east slope, *5838*; infrequent, south slope, *5875*.

Pedicularis labradorica Wirsing. Infrequent, east slope, *5821*; infrequent, south slope, *5869*; infrequent, tundra, *5849*.

LENTIBULARIACEAE

Pinguicula villosa L. Rare on *Sphagnum*, marsh, *5851*.

RUBIACEAE

Galium trifidum L. Rare, bank thicket, *5898*.

CAPRIFOLIACEAE

Linnaea borealis L. var. *americana* (Forbes) Rehd. Rare, east slope, *5835*.

Viburnum edule (Michx.) Raf. Rare, east slope, *5820*.

COMPOSITAE

Arnica lonchophylla Greene. Rare, east slope, *5833*.

Artemisia tilesii Ledeb. Infrequent, *Alnus-Betula-Salix* thicket along stream on south slope of plateau just below summit, south of lake, *5884*.

Petasites frigidus (L.) Fries var. *palmatus* (Ait.) Cronq. Rare, *Alnus-Betula-Salix* thicket along stream on south slope of plateau just below summit, south of lake, *5885*.

Petasites sagittatus (Pursh) Gray. Infrequent, marsh, *5888*.

Senecio indecorus Greene. Rare, south slope, *5864*.

Senecio lugens Rich. Rare, east slope, *5823*, *5828*; rare, south slope, *5877*.

Solidago multiradiata Ait. Rare, east slope, *5839*; rare, south slope, *5870*.

ACKNOWLEDGMENTS

For determinations of some collections I am indebted to the following specialists: John W. Thomson, Lichenes; William C. Steere, Bryophyta (except *Sphagnum*); H. L. Blomquist, *Sphagnum*; T. M. Barkley, *Senecio indecorus*; and George W. Argus, *Salix*.

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The attention of readers is directed to to the announcement of the Canadian Audubon Society on the outside of the back cover of this issue.

OBSERVATIONS ON SOME BREEDING WATER BIRDS ON BYLOT ISLAND

William H. Drury, Jr.

The 1954 Bylot Island Expedition spent from 12 June to 29 July at the mouth of the Aktineq River on southern Bylot Island, approximately 73° North Latitude and 79° West Longitude, Northwest Territories, Canada.

A lively, popular account of the trip is given in Scherman (1956) and a short description of the weeks at camp by Drurys (1955). Places near our camp referred to in the text are shown in Figure 1. The island, our camp, and

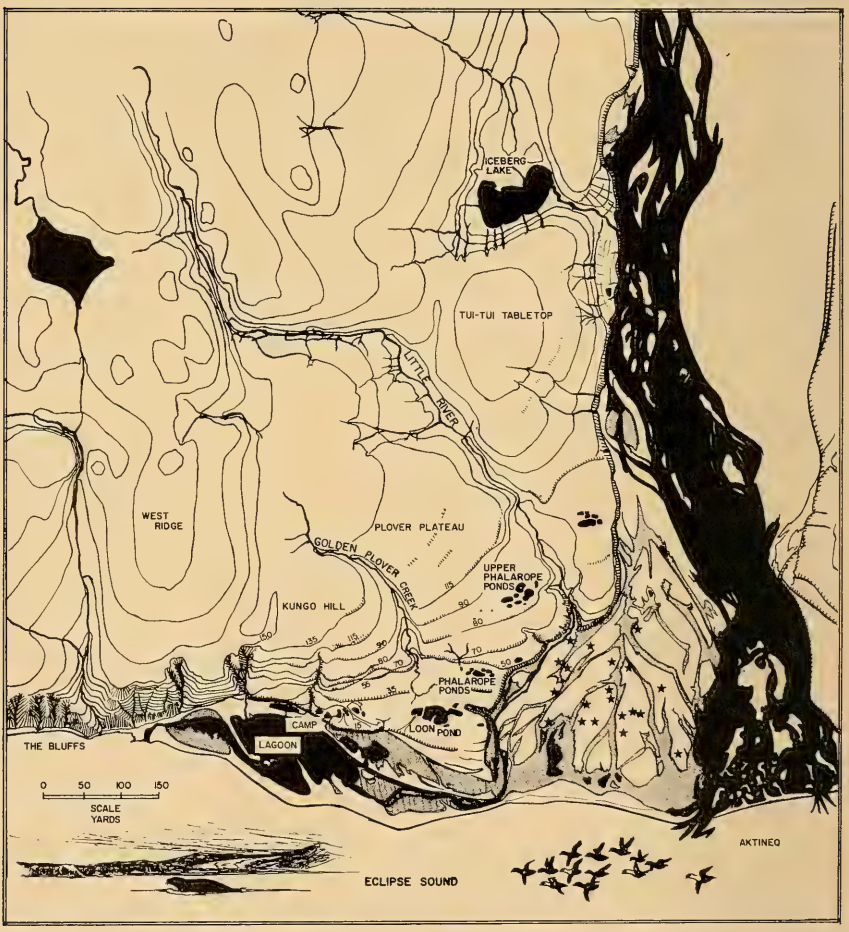

Figure 1. Field map of the study area. Contour lines are used to indicate approximate topography. Altitudes were established by hand level.

other localities referred to, are shown on maps in Miller (1955), Scherman (1956), and Van Tyne and Drury (1959).

The expedition was supported by a private grant and by the New York Zoological Society. Arrangements were made through the Arctic Institute of North America.

This report was prepared while I was on sabbatical half-year at Harvard University, 1955. Josselyn Van Tyne's sickness and untimely death prevented the preparation of a combined report and delayed the publication of this material.

RED-THROATED LOON

Gavia stellata (Pontoppidan) (Eskimo: Koksáu or Koksów)

AERIAL DISPLAY

Two pairs displayed over camp in June. We saw and heard the first flight on the day we first saw loons, 15 June. Flights (Figure 2) were infrequent and followed irregular routes until 21 June. By then, a single bird flew a regular route about a dozen times a day, upriver to Iceberg Lake, downriver, diagonally across upper Phalarope Ponds, and 400 yards over the ice on Eclipse Sound.

The usual call – *arrgh*, *arrgh* or *ka*, *ka* or *cow*, *cow* – was given in a slowly increasing tempo to a crescendo followed by a rapid diminuendo. Several times at the crescendo the bird called *kagów* (Eskimo name, Koksáu), started again and built up to another crescendo. Sometimes the bird grunted quietly at each wingbeat.

The flights and calls have been described from Greenland by Manniche (1910), Pederson (1926), and Nicholson (1930), and from Bear Island by Duffey and Sargeant (1950), but have not been mentioned as such by observers in England and Spitzbergen (Huxley, 1923; Van Oordt and Huxley, 1922; Keith, 1937). Keith's continual "harsh, sharp *kark*" in flight may be this call. We heard no four-part phrase (Sutton, 1932; Nicholson, 1930).

Four birds had arrived by 17 June and by 26 June displayed as two pairs. One bird of each pair gave the crescendo call, while the other flew with bill closed. Sometimes the caller led, but often flew from behind past the silent bird and waved its head up and down, holding it level (Figure 2). The silent bird often changed its course, and then the caller quickly flew past and gave the crescendo call again. Sometimes the pair gave the crescendo call after we had frightened them out of a pond.

Toward the last of June, both birds called in flight: one loud, long and steadily, and the other for short periods echoing the other. The birds flew at about 100 to 300 feet, never rising so high that they were specks, as described from Greenland by Manniche. At the end of a flight, the birds set their wings and glided at a steep angle to the lead in the sea ice off the mouth of the Aktineq River (Figure 3). We saw no aerial swerving described by Sutton (1932), although birds swerved and slipped when losing altitude rapidly. The last flew and called together on 1 July, and the cry had stopped by 5 July. We heard it again on 13 July at Ooyarashukjooeet (map in Miller, 1955), and on 28 July at camp after the female was shot (see below).

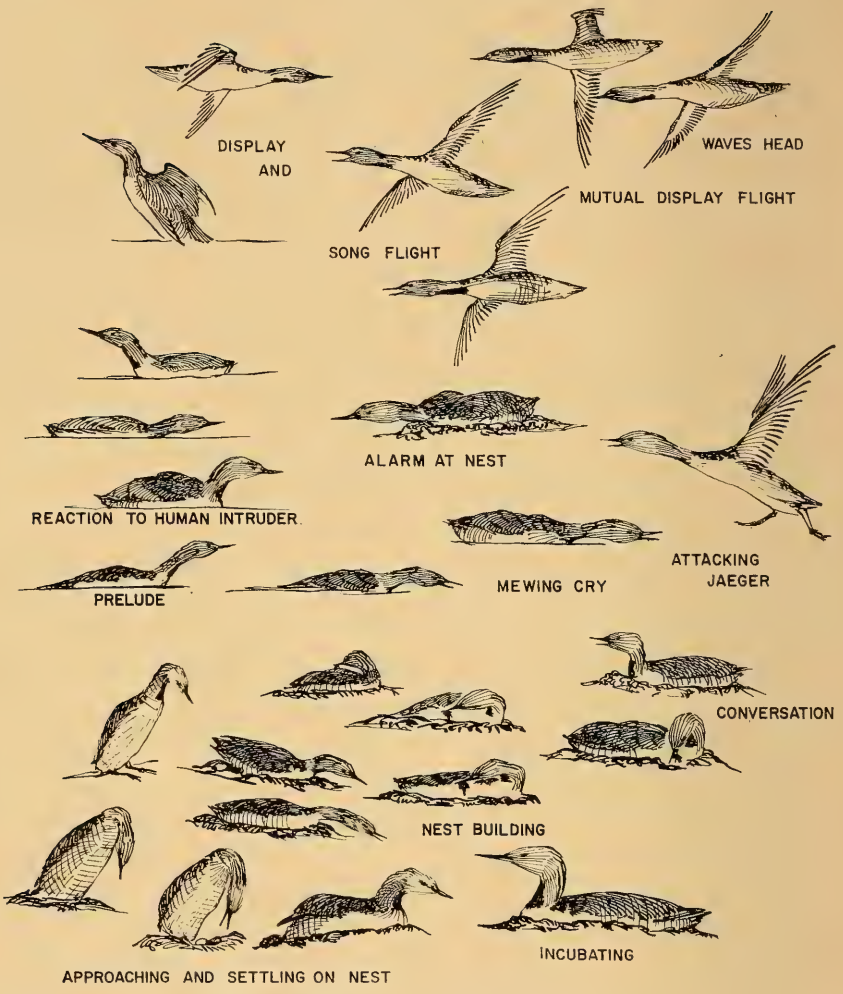

FIGURE 2. Displays of Red-throated Loon, I.

AGGRESSION

We saw eight loons off the Aktineq in mid-July, and groups of four and three at Ooyarashukjooeet on 14 July.

In both places we saw actions (Figure 3) which resemble those Huxley and Keith describe as aggressive. The birds swam together with necks stiffly stretched up and heads horizontal; occasionally one dipped its head into the water up to the eyes. They called *och óh uh* two or three times in a low, throaty tone, and occasionally *kwowp* (Nicholson's courtship chorus ?). Then one dove with a splash from this stiff position ("splash-dive"), at which the

other raised its wings, held them stiffly, and ran around over the surface of the water, changing direction several times (Huxley's "wing Plesiosaur race"). When the first one came up suddenly, almost vertically out of the water, both cried *och óh uh* with heads held low over the water and throats greatly distended. At the Aktineq both birds added a mewing *keeee ooooo*. Then one lowered its head and swam at the other, progressively faster and with more splashing, finally raising its wings. At this, they both often ran around over the water, then suddenly settled into the stiff position with heads raised.

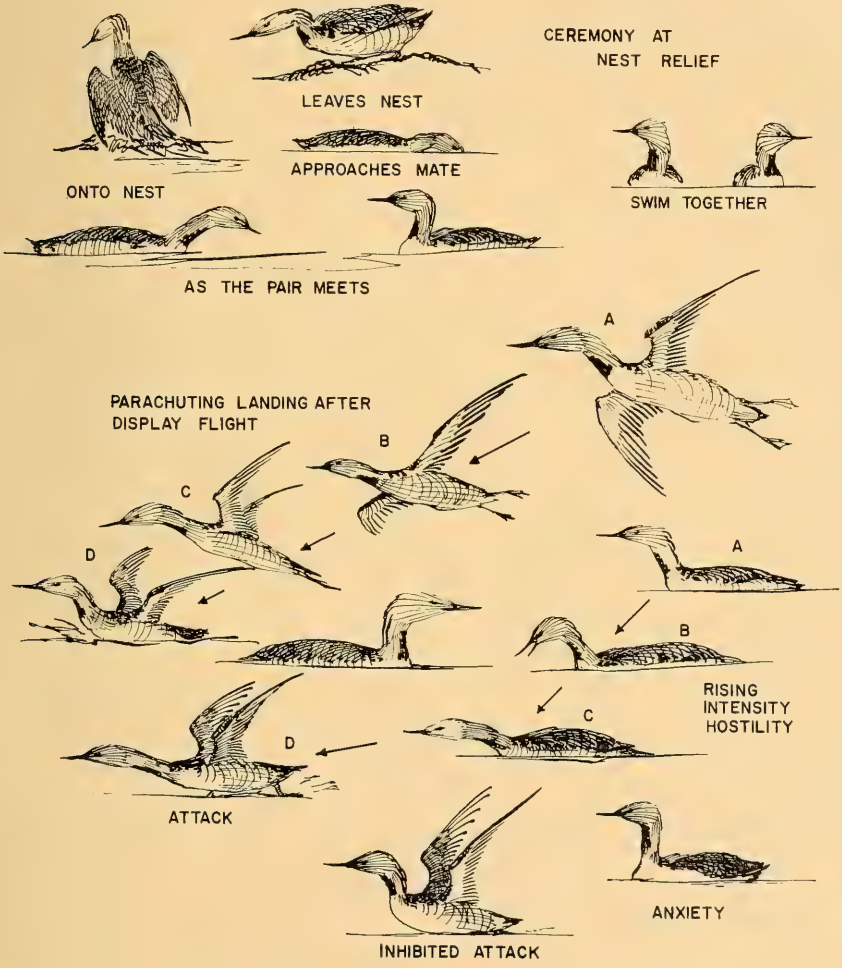

FIGURE 3. Displays of Red-throated Loon, II.

Two Birds Meeting. When one bird flew in from the lead in the sea ice and landed in the pond, the loon on the nest came down and swam toward it with head lowered and bill pointed slightly downward (Figure 3). The new bird floated unmoving with head raised and neck bent slightly forward (Figure 3), while about 20 yards away the loon from the nest dipped its head into the water. The two swam toward each other and then turned so that they were swimming side by side. They turned 180 degrees and swam side by side, first looking ahead and then away from each other, moving their heads mechanically. Then both dove. Shortly afterward, one flew off over the Aktineq River and gave the crescendo cry twice before it settled into the lead.

In Varangen, northern Norway, in July 1958, I saw Arctic Loons (*Gavia arctica*) swim slowly toward each other, then in circles around each other, as one bird met a group of three. They too turned their heads first away then toward their companions. In both species, this action alternately shows the gray nape and specially colored throat. These various postures are perhaps best considered as various intensities of hostility concerned with individual recognition, and include what is perhaps a type of "head-flagging" (Tinbergen and Moynihan, 1952). The same elements of aggression and fear presumably were combined in the actions Höhn (1957) described as distraction display on Banks Island.

NEST AND EGGS

Nest Site. We found one nest on the shore of a pond 20 yards by 35 yards, and a previous year's nest (also of mud, sedges, aquatics and moss) on the gravel ridge on the seaward shore of a fresh pond 20 yards long and 10 yards wide on the six-foot beach in front of camp. All ponds where we saw loons were less than 50 yards long. Unlike other loons, this species needs to run only a few feet to get into the air.

Nest Establishment. Between 15 and 21 June, a pair visited the ponds between Golden Plover Creek and Little River (Figure 1). On 21 and 22 June a pair still spent most of their time in the brackish lagoon in front of camp, but visited Loon Pond. On 25 and 26 June we saw a pair in the larger of the Upper Phalarope Ponds for the last time. On 28 June they called in alarm as they left when we came near Loon Pond. Huxley suggested that paired birds select the nesting site.

Nest Building. On 28 June, one bird was nest building on the shore of a tiny moss island (later a peninsula as the water level dropped) on the east shore of Loon Pond. It picked up muddy moss, and holding the bill horizontal, swept its head along its side, brushing the back of its head over the scapular feathers), and threw or dropped the moss by its side or flank (Figure 2). A few minutes after being frightened from the nest, the bird went back to a spot two yards from the site and plucked mud and moss from the pond bottom, dumping it over its back beside the nest. Huxley (1923) saw this, but said that the bird showed no further interest in the moss; and Manniche (1910) also described fetching nesting material. The bird we watched returned to the nest, turned to face the water, and transferred onto the nest the muddy pieces. While doing so, it moved around and around, sometimes picking up pieces it had just dropped,

but always dropping the pieces over one shoulder or the other. It opened its bill about once every two minutes as if 'talking' to the other loon which loafed at the opposite end of the pond. Only one bird worked at a time.

Egg Laying.. Between 1640 and 1655 on 28 June, the female laid the first egg without any noticeable movements. There was only one egg on 30 June when we checked the nest through a telescope, and there were two eggs on 1 July. The two loons were usually together at the pond during this period.

Nest Relief. Because we watched the actions of two birds in the pond so many times, we are convinced that both parents incubate and that this was part of the change-over. The bird returning to the nest crawled slowly up the same route to the edge, awkwardly and with great effort. It stood, moved the eggs with its half-opened bill, and flopped down on them (Figures 2 and 3). The bird shuffled back and forth, often holding its wings slightly lowered while it worked itself down onto the eggs. Often, after about a minute, it stood again, moved the eggs with its bill, and shifted to face the water. When the bird opened its bill to do this, it seemed to move the upper mandible more than the lower. Johnson (1935) reported that the birds attempted to move the eggs with their feet; then, failing that, moved them into position for the brooding patch with their bill. We noticed the birds shifting their feet while on the nest, but thought it correlated with (1) getting into position to shift the eggs with the bill, or (2) nervousness, that is, getting their feet under to be ready to flee. On 18 July one egg was cracked, but it hatched.

Hatching. Both eggs hatched on 26 July, incubated slightly more than 26 days. We took one downy young and during two days of cold rain which followed, the other died. Johnson (1935) reported that 10 pairs built 13 nests in which 7 eggs hatched, and 3 young were fledged, each from a different nest.

Of the species studied, the loons were the most regular in their daily activity rhythms. They were active and noisy between 0600 and 0930, again from 1700 to 2130, and quiet between these times.

REACTIONS TO INTRUDERS

To Humans. When the birds in the leads saw us, they stopped and approached with heads high, occasionally crying *kowp*. Before incubation, when alarmed by people coming within 300 yards, the bird left the nest with its head low over the water. It dove almost at once and came up at the opposite edge of the pond.

If the other loon was there, the two swam with heads low and necks stretched along the water (Figure 2). One or both called *ga-krrrrrroit*, *koi rrrrrrrrrow*, or *ka-whoit*, *ka-whoit*, a cross between a growl and a yodel. If both called, they did so in a syncopated duet, one calling *ga* as the other called *krrrrrroit*. We heard this several times from the lead off the Aktineq. It has been recorded by all observers. Huxley named it "roll-growl" and suggested that this cry is associated with the early stages of courtship. We thought it indicated alarm and hostility.

In the first week of July, the incubating bird left when we came within 100 yards; when the young had hatched, it held until 20 yards. As we approached, it bent its neck slowly forward, finally flattening its head against the ground below the body level (Figure 2). This has been described as

concealment and it makes the bird much less conspicuous. Keith (1937) showed that it is taken in response to the "roll-growl," and toward eiders near the nest. Both fright and hostility are involved.

When we found the second young dead, we took the female, and after that the male visited the nesting pond several times, each time flying over camp and giving an abbreviated crescendo cry.

To Birds. On 28 June, the loon building suddenly left the nest, mewed a low cat-like cry, *kreeee-ooooooo-weee, keeerow,* and joined the other. They then cried together, as a Parasitic Jaeger (*Stercorarius parasiticus*) flew in and hovered over the nest, which had one egg. The loon that had been building flew, running across the water with its head lowered, mewing, and drove off the jaeger (Figure 2).

Huxley reported this cry directed to a jaeger, while Keith felt it was directed toward the mate only, though associated with nest defence. If mewing is a form of communication between the pair, indicating a conflict of alarm and nest defense, there is no contradition.

FEEDING

The loons fed in salt water in the brackish lagoons and in the leads at the mouths of the large rivers. The many hostile actions indicated that these were territorial birds attracted to common feeding areas.

SUMMARY

1. Two pairs of Red-throated Loons displayed over the study area. We saw a total of 14 individuals on the south shore of Bylot Island.
2. They gave a crescendo call at 100-300 feet during the display flight.
3. Aggressive postures consist largely of lowering the head and distending the throat. Several long calls are associated with these actions.
4. The pair prospected several ponds over half a mile before building on one 35 yards long.
5. Nest building consisted of pulling up mud and moss and dropping it over the shoulder in several positions on the nest.
6. The first egg was laid 28 June and the second 1 July; both hatched 26 July. The nest was occupied continually after 29 June.
7. When the female was taken, her mate started the crescendo cry again.
8. All feeding was done in salt water.

GREATER SNOW GOOSE

Anser caerulescens atlanticus (Kennard) (Eskimo: Kungo)
Chen hyperborea atlantica of A.O.U. Check-list 1957

MIGRATION AND ARRIVAL

We saw about 30 geese at Pond Inlet on 11 June, and flocks of 6 to 30 birds at camp during the first week. The total within three miles probably was 150 to 200. (Ellis (1956) found about 200 two miles inland at the Aktineq on 14 and 15 June 1955). Until 25 June, small flocks flew in from the west several times a day (especially 0600-0900 and 1700-2200), passing low over the tents and a few feet above the ridge crests to go upriver to feed. Another flyway led along a large tributary on the west side of the river about two miles north of camp. We saw a flock of 15 on 30 June, then only molting birds until one flying bird in the last week of July at Oonakuktooyuk.

DISTRIBUTION AND DENSITY

Snow Geese occurred all over the uplands. Panilu, a member of the Eskimo family staying with us (Drurys, 1955), found nests six miles north of camp. At Oonakuktooyuk and Ooyarashukjooeet, we found geese in as large numbers as at Aktineq. We found four nests in our study area, and two across the river to the east.

AGGRESSION

Aggressive displays were unusual in the feeding areas, but common among the pairs which separated from the flocks and visited snow-free places on ridge and terrace crests. In aggressive action, one bird lowered its head, neck stretched forward and bill open, and walked or ran at a neighbor (Figure 4),

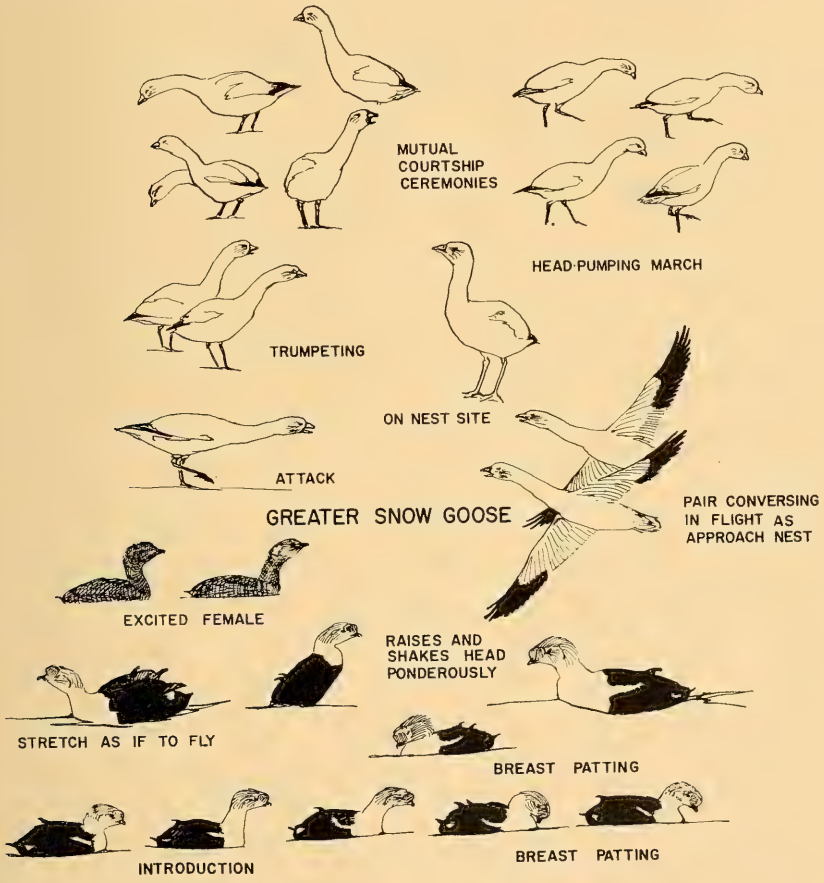

FIGURE 4. Displays of Snow Goose and King Eider.

sometimes opening its wings at the end of the advance, thus making a vivid flash of the black wingtips 'at' the opponent.

PAIR BOND

Triumph Ceremony. One of a pair that had occupied a small meadow above the Bluffs rushed at a pair that flew in and settled on 'their' meadow. The rush ended with several wingbeats and as the visitors flew, the aggressor returned with head high, trumpeting, and beat its wings twice as it arrived next to its mate. The mate arched its neck and lowered its head. This territorial action indicated at least resistance to dense colonial nesting.

Mutual Display. The most common action in small groups (4 to 10) that had withdrawn from the main flock was mutual. The pair walked slowly holding their necks crooked); one of the pair held the head lowered and the other held its head pointed up and called *gang gang gang gang gang* (Figure 4). The tracks showed that pairs and small groups walked hundreds of yards over the snow on ridges and high flat places. Flocks and pairs flying over the uplands often called steadily, as do most paired geese on their breeding grounds before incubation starts.

Most of the courtship must have preceded our arrival, for we found two nests with eggs in the first four days. It is reported that birds are paired when they arrive on their breeding grounds, although we find no discussion of pair formation on wintering grounds. McIlhenny (1932) speaks of males of the "Lesser Snow Geese" in Louisiana fighting hard and long, striking each other with their wings, in late March. Soper (1942) remarks that the Blue and Lesser Snow Geese, *Anser* (*Chen*) *caerulescens*,* are evidently paired on arrival "as no mating demonstrations were observed" in the north.

Precopultatory Actions. In the last ten days of June, we often saw a pair walking along, suddenly jerking their heads down and crooking their necks (Figure 4); then jerking their heads up and chins in toward their bodies. Sometimes as one walked trumpeting, the other accompanied it, pumping its head.

Threat, triumph and precopulatory ceremonies in Canada Geese (*Branta canadensis*) involve much more violent and snake-like movements of the neck than these. Threat actions of Snow Geese and of other Gray Geese (*Anser*) are expressed with head closer to the ground. The 'use' of the primaries at the end of the aggressive rush is not as noticeable in other geese.

NEST

Site. On southern Baffin Island (Soper, 1946), Southampton Island (Sutton, 1932), and in the Thule district of Greenland (Gibson, Freuchen, Rasmussen and Ekblaw, as summarized by Salomonsen, 1950), nests are on dry places in grassy or marshy low land near a small lake. These authors report nests in colonies, as do Tuck and Lemieux (1959) on Bylot Island. White and Lewis (1937) summarize the knowledge of nine Royal Canadian Mounted Police from Pond Inlet and other northeastern posts: "a nesting ground is a level, poorly

*I agree with European authors (Witherby, *et al.*, 1941) that Snow Geese are not worthy of separate generic status from *Anser*. The conspicuous interbreeding in the Hudson's Bay region is proof that Blue and Lesser Snow Geese are conspecific, but the interesting question remains whether or not Greater Snow Geese, *Anser* (*Chen*) *hyperboreus*, are a separate species. Bylot Island may be in a lucky position to test this idea. (Van Tyne and Drury, 1959).

drained area, sometimes two or three miles in extent, over which the nests are usually widely scattered."

The nests we found were widely separated, on well-drained sites near large boulders and on knolls or hill crests from which the snow was gone before 12 June. All sites had an uninterrupted view and we often found owl pellets near nest sites. Many nests were among the hummocks associated with lemming burrows. Verdant vegetation results from the soil stability near a large boulder and drainage on the ridge top; these, and lemming fertilization, produce hummocks which seem to attract the geese. In eight of ten nests, the immediate surroundings were nearly barren soil or rocks. Idlouk, our Eskimo companion (Drurys, 1955), said these exposed sites were the typical nesting site.

Lemieux (1959) found the geese on Bylot nesting in colonies of 25 to 300 nests often only 15 to 20 feet apart, but comments that the Eskimos say the geese seldom use the Aktineq Valley. He says that typical colony sites are on west-facing, protected slopes of river valleys where nests are sunken in a shallow depression in a dry site.

The detailed surroundings of our sites agree, although the topographic placing differs. I suspect that the difference in observations is caused by the fact that his were of a real colony, while ours were of isolated birds in a region where the geese do not usually have a colony. When we asked Idlouk to find geese for use, he did not go inland at Atkineq but to the river valleys of Aktineqjuak and Ooyarashukjeet. This agrees with Lemieux and the reports the Eskimos gave him.

On Bylot Island in 1954, because the birds were already physiologically ready for nesting, the sites they chose were the first free of snow. Different snow conditions at the time of arrival in the Hudson Bay region may lead birds to nest in marshes if they are available. Marshall (1952) discussed the effect of nesting site availability on egg laying.

Detailed descriptions of ten nests are available at the Hatheway School in South Lincoln, Massachusetts. These descriptions include elevation, location, and description of site, topography of the location, details of the surrounding vegetation, and materials used in nest construction.

Nest material included any coarse vegetation within reach of the nest: Bell Heather (*Cassiope tetragona* [L.] D. Don), Arctic Willow (*Salix arctica* Pall.), grasses, sedges, and Grass Rush (*Luzula confusa* Lindeb.), as well as lichens and down. Nests had little down until there were four eggs in the clutch.

Clutch. We found four nests, 16-20 June, with clutches (4, 4, 3, 2).

Nest Success. Six nests were robbed and two clutches brought to us in the first few days before the Eskimos understood that we wanted to study the breeding of the birds, not collect them. Two nests were destroyed by Arctic Fox (*Alopex lagopus*), one of which followed our tracks to the nest. Predation on the breeding population on Bylot Island by Eskimos was insignificant, because they seldom go more than six miles after eggs, which are a delicacy. This left 98 per cent of southern Bylot unvisited and there are no Eskimos on northern Bylot.

In the fall of 1954, aerial photography censuses at Cap Tourmente, Quebec, reported by the Canadian Wildlife Service (Louis Lemieux, letter of 23 May 1955), showed one young bird to fifty adults. Our observations indicate pressure by Arctic Foxes in southern Bylot Island. Perhaps an unusually late thaw and stormy summer, and unusual predator pressure on those that did nest (correlated with the lemming crash) may explain the breeding failure. Such catastrophies must be expected as a regular part of the selection pressure on high arctic nesting species. Lemieux (1959) says the geese were not bothered to any great extent by predators on southern Bylot Island in 1957.

REACTION TO INTRUDERS

When approached while feeding on the ground or while on the nest, geese flushed at 200 yards, but they readily flew within 50 yards and settled within 100 yards of a sitting person. Flying birds were easily decoyed by imitating their flight cry, *khlang*, and Panilu and Idlouk called geese to within 40 to 60 yards by sitting down, pulling in their arms, and flapping their empty sleeves.

FEEDING

Geese grazed in the sedgy meadows free of snow, either on hilltops, or in abandoned channels of the river. The many ponds on hilltops – results of thawing permafrost (Wallace, 1948) – were often surrounded by extensive sedgy meadows. The geese also spent much time in newly thawed places, plucking grass and sedge roots, and picking leaves of new growth. Wherever they grazed, there were several of the little double pits made by the probing bills in each square foot, and droppings were everywhere – a major source of fertilizer for the sedge growth.

The stomachs of geese taken during June contained a few small grass and sedge shoots and coarse grains of quartz sand. We found no traces of *Oxytropis* (reported by Lemieux) in the stomachs we examined.

SUMMARY

1. Some Greater Snow Goose nests had completed clutches when we arrived, but most of the population remained in flocks of up to 75 birds, feeding and prospecting ridge tops, until 30 June.
2. After the first of July, Snow Geese disappeared until we saw a single flying bird on 22 July.
3. We saw hostility displays, a triumph ceremony, and mutual ceremonies of paired birds.
4. We found no evidence of colonial nesting, and all nests were on ridge crests with unrestricted view.
5. The nests were of any large plant material, and fully lined with down and feathers only after there was a clutch of four.
6. The late snow-melt, combined with the low ebb of the lemming population which directed fox predation to the nests of these and other waterfowl, may have been responsible for the near failure of the breeding season of Greater Snow Geese in 1954.

OLDSQUAW

Clangula hyemalis (Linnaeus) (Eskimo: Ahgyeeahtsuk)

ARRIVAL

We first saw Oldsquaws, a flock of six, flying in from the sea ice on the morning of 15 June. A drake, recognizable by well-marked plumage, arrived then and stayed near camp for the rest of the season. By 22 June there were 17 pairs on the shallow lagoon at camp, but when other lagoons and leads opened, this flock decreased to nine pairs which stayed through the period of display, mating, and egg laying. We recognized individually six drakes in this flock by patches of winter plumage. We could not recognize individual females.

HABITAT

Oldsquaws occupied shallow lagoons behind beach bars until incubation started, when the drakes moved out to the leads at the mouths of rivers. Ducks visited ponds in the uplands as soon as they thawed, and many returned daily to the lagoons and river mouths during incubation.

DISTRIBUTION AND DENSITY

We found two nests in our area (but nine pairs regularly on the lagoon). On 10 July there was a flock of 40 drakes and 16 ducks in the sea at the mouth of the Aktineq. We saw over 200 in the open water at Ooyarashukjooeet on 8 July, and 12 July. On 21 July we saw two ducks in each of two ponds, and three ducks in each of another two ponds, two to six miles north of camp.

DISPLAY

We have no information on the changes of behavior of individual pairs during the breeding cycle. Birds seemed to be paired when the flock arrived and there were only two or three surplus drakes; but mass courtship antics continued until the middle of July. These communal activities may have been a general physiological stimulation while pairs remained constant, but without recognition of individual females, we could not make sure. Drakes courted any duck that solicited, and as soon as a duck showed interest, a melée of drakes gathered excitedly around her.

We saw no territorial behavior as described from Greenland by Salomonsen (1950) unless the pursuit flights were modified territorial flights related to those of the Anatinae (Geyr, 1924). But the wide spacing of nests on the uplands suggests some territoriality. The late persistence of ice on inland ponds may have prevented normal territorial segregation.

Actions. All the actions I saw at Bylot in courting flocks I have seen in late winter on the wintering grounds. I was not able to detect a separate set of pair-formation and precopulatory displays as is suggested, for instance, in the displays of Goldeneyes (*Clangula clangula*), (Dane, Walcott, and Drury, 1959; Lind, 1960). The display postures are more similar in form to those of Goldeneye, Bufflehead (*Clangula albeola*), and Mergansers (*Mergus* sp.) than to any other group of ducks.

Display actions by the duck (Figure 5) were: (1) holding head up as if nervous; (2) tossing head and calling *urk, urk, urk, ang ang ang goo*, or *gut-gut-góoah-góoah;* (3) stretching head along the water, but bill above water;

and (4) sitting hunched up with chin on breast as if cringing from the melée of rushing drakes around her.

The drakes' actions (Figure 5) included: (1) constant calling *ahang-ahóo*, tossing the head; (2) holding head high as if nervous, with tail at 45° angle; (3) a short, stiff flight up, and an abrupt parachute to the surface; (4) an exaggerated bow from the head-high position; in this, the bird, thrusting with his feet, drove his breast deep in the water, holding head up and sometimes pointing his bill up; at the same time his tail end was raised out of water; (5) rushing at another drake with head down and bill open (wings open or not, and tail cocked or not); (6) catch-as-catch-can fights including pursuits of

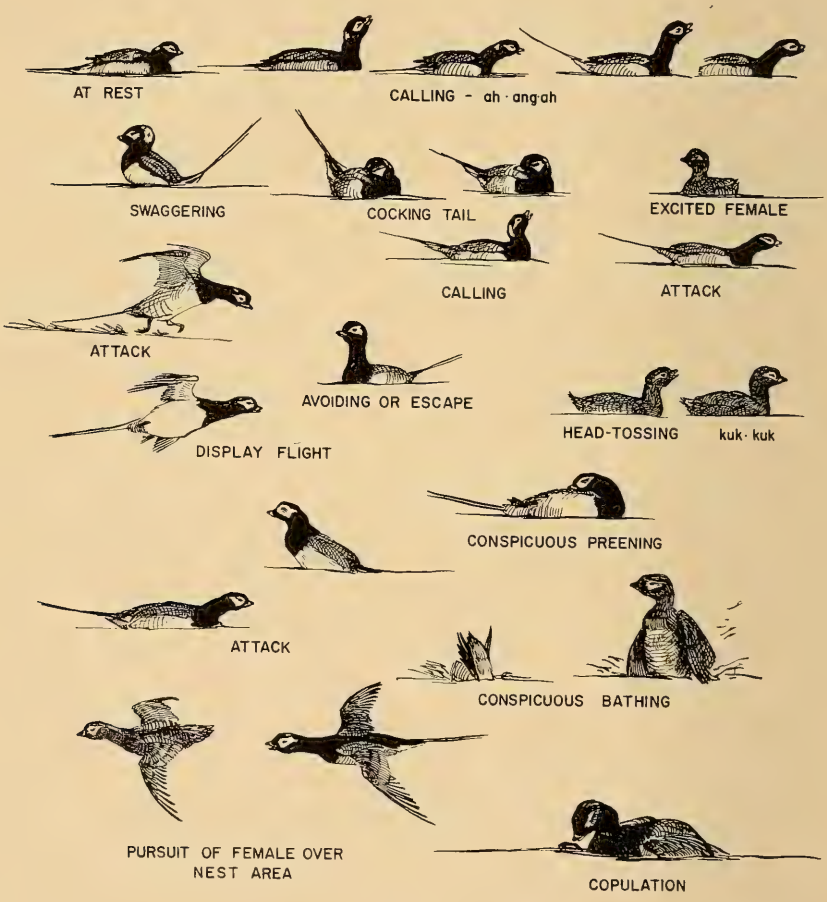

FIGURE 5. Displays of Oldsquaw.

other drakes and of a duck by several drakes (under water or in the air); (7) swaggering past the duck with chin pulled in and tail cocked up (or occasionally being coked at intervals of a second, or jiggled). In addition, there were pursuit flights over the uplands, in which the participants were mostly paired.

The drake gives his call, *ang ang*, while tossing the bill to an angle of about 45° with each syllable. The final phrase is given either lowering bill for *ang*, then tossing bill up for *eeeoóo*, or pointing the bill up vertically for the *ang* and swinging it forward and down for the *eeeoóo*. While the drakes constantly called *ah angúh*, the ducks clucked or called a lower and less loud *ah-ang*.

Flock Displays. Between 0700 and 1100, but especially between 1800 and 2200 during the last week of June and the first week of July, five to nine drakes and one to four ducks gathered in the lagoon. Drakes displayed to all ducks and met with more or less indifference from the ducks and hostility from the drakes. At these times, single ducks or several together often loafed nearby on small ponds or inlets in the lagoon, not taking part in the activities but craning their necks and acting nervously.

When one drake started to call and toss his head, it usually started several others. One drake often lowered his head and swam or rushed, half flying, at another drake which, raising his head high and cocking his tail, swam out of the way or flew off. Occasionally one drake dove and pursued another under water. If the second drake stood his ground, the attacker seized the feathers of his head or neck and a splashing, beating melée of wings and water followed, which attracted other clamoring drakes.

Often a drake flew up from the group and the rest of the flock followed; then the whole flock, calling like hounds, swept up and down the lagoon and over the bar before returning to the same part of the lagoon. Many times however, none of the other drakes followed, and the flying bird landed 50 yards away, called, and swam back into the melée which had continued without him. For such a flight to continue, a duck had to fly up, and she actually led the flight. Sometimes these rushing zigzag flights took the birds high in the air and they tumbled back to the surface with a rush of wings. Flocks moving through on migration, and individual pairs coming low over the crests of Kungo Hill on their return from inland, dove on noisy wings to the lagoon in this way. The birds we watched always landed in a normal way, not by flying into the water as Sutton (1932) describes. The towering pursuit flights and noisy dives had stopped by 25 June. After a two- to five-minute period of activity, the flock was usually quiet for twenty minutes to an hour.

On 24 June we watched what must have been competition between two drakes for one duck. A drake that was not usually seen in the lagoon repeatedly swam up to a duck and was attacked by the other drake. For a long time the duck showed no preference for either the newcomer or the familiar drake. As soon as she started to follow one drake closely, the melée broke off.

Copulation. On the night of 1 July, we saw one duck on the lagoon and a couple of others resting on small ponds around its edges. Out of the midst of one of the melées, a drake flew directly to one of the ducks on a small pond, mounted and forced the duck under water, held by the feathers of the top of her

head (Figure 5). This observation suggests that there are no precopulatory displays in Oldsquaw, but other indications of relationship to the Merginae suggest that such is unlikely.

Entering a flock soon before or after copulation is known in other species such as Blue Jay (*Cyanocitta cristata*) and House Sparrow (*Passer domesticus*). The Oldsquaw communal display resembles that of House Sparrow and the origin and function in this species may be similar to those suggested by Summers-Smith (1954). Other ducks, for example, Anatinae, have courting parties and concentration of courting activity in certain places. The localization of male courtship activities to certain areas is similar to display leks of shorebirds and gallinaceous birds.

The Pairs. Pairs of Oldsquaws spent many hours standing, preening, sleeping, and plucking at grass on the shores of small ponds, such as the Phalarope Ponds and Loon Pond. Occasionally a duck made motions of ordering the sedges and mosses around her into a nest, picking up pieces of sedge and dropping them beside and behind her with a few shakes of her head. On 24 June, a duck did this and later that day we found the first Oldsquaw egg near that place on the shore of Loon Pond. Kidla and Leah, two of our Eskimo companions, said that they often find Oldsquaw eggs dumped this way.

Drakes on the water occasionally preened breast, flank and belly feathers in such a way that the expanse of white belly was kept exposed to a duck (Figure 5). Ducks usually bathed as do most ducks, with head and breast held high, beating the wings rapidly against the sides; but also repeatedly splashing with head under water and tail and after-end of the body out of water close in front of the drake (Figure 5).

NEST

During nest-site selection, nest building, and egg laying, pairs flew over the tundra slopes muttering *urk-urk-urk* quietly (Figure 5), and occasionally landed and walked around. When flying from the lagoon to the uplands, the drake followed the duck and called *ung ow geeóoga.* If several drakes started after one female on her flight inland, all but one turned back to the lagoon before they passed Kungo Hill. Sometimes we saw two ducks followed by one drake. Nest-prospecting flights were numerous in late June in the evenings from 1700 to 2200.

Idlouk, Panilu, and Leah said Oldsquaws nest near small ponds in mossy tundra. We found two nests on gentle slopes with complete vegetation cover, one west of Iceberg Lake and one on Tui-Tui Tabletop. These slopes were exposed by the general thaw during 24-28 June. Each nest was near a boulder and within 50 yards of a pond. The nests were made of grasses, sedges, and Bell Heather shoots, and were heavily lined with light-centered gray down when the clutch was complete. We found a third nest of similar construction among sedge tussocks near Aktinekjuak. During incubation – after July 1 – the ducks spent much of their time on the uplands and returned in the evening to dive and bathe in small groups in the lagoon.

Three nests found on 7, 14, and 20 July each contained seven eggs. Both nests studied were destroyed by jaegers.

CLOSE OF THE DISPLAY PERIOD

We saw the last calling and a melée of splashing on 9 July at 2000. On 15 July at 2230, there were 14 drakes and 11 ducks on the lagoon and 5 ducks on the fresh pond on the six-foot beach. There was no melée but the ducks on the fresh pond were calling. The nine drakes joined other drakes on the open water at the mouth of the Aktineq and formed a flock of 16-23 drakes on 15-20 July. The six males could be identified in the flock.

In mid- and late July, the drakes molted the conspicuous long, pale-edged scapular feathers and some lost their long tail feathers, but we saw no other plumage changes. We found no Oldsquaw that had lost the power of flight.

REACTIONS TO INTRUDERS

Our daily checks of the two nests near camp were probably responsible for their destruction. The ducks sat until we were within three or four feet before they flew off, soiling the eggs. Both ducks used to fly to small pools in the Little River, or a pool in a soil polygon. When we found ducks on small ponds on the uplands, they usually called *kuk kuk kuk* or *kuk ang kuk*.

FEEDING

The flock fed in deep water near the outlet of the lagoon during the day and moved to the shallow central part to rest and display. We found only tiny fish and no shellfish in the lagoon. As soon as the flock moved out on the Sound, they fed at the edge of the ice and close to the beach.

Salomonsen (1950) says that Oldsquaws do not take their young to lakes with through-flowing streams, as they are poor in plankton because of Arctic Char (*Salvelinus alpinus*). Char are not known on Bylot Island, and three of the ponds on the uplands where we saw Oldsquaw ducks had streams running through them.

SUMMARY

1. We saw the first Oldsquaw on 15 June. Nine pairs stayed on the lagoon until 16 July, when the ducks were regularly incubating and the drakes joined a flock on the sea.
2. Pairs seemed formed when they arrived, but some unattached drakes were present and mass courtship activities occurred throughout the preincubation period. Displays are similar to those of the other Merginae.
3. We saw copulations in the last week of June and the first week of July. They were associated with, but separate from, communal display.
4. We found two nests, each with seven eggs, on the mossy upland tundra; both were destroyed by jaegers.
5. By the second week of July, the drakes were losing their conspicous scapular feathers and some of their long central tail feathers, but we saw no other plumage changes.

KING EIDER

Somateria spectabilis (Linnaeus) (Eskimo: Kingalik; Meetuk for eiders in general)

We saw an adult drake and two ducks on 24 June in the lagoon in front of camp, and a pair on Loon Lake on 28 and 29 June. Mixed flocks averaging 30-60 birds (one-third adult drakes, one-third young drakes, and one-third

females) flew west past camp during the wet easterly winds between 29 June and 22 July.

Flocks averaging 30 birds fed in the shallow water near the river bars and climbed freely onto the ice, gravel bars, or beach where they slept and preened. A flock of 135 at Ooyarashukjooeet which had been feeding and loafing suddenly gave a soft murmuring sound rising in intensity and crowded together with their heads raised nervously. They moved off in one direction for about 150 yards, turned, swam to the ice, and all climbed out. A ripple of wing flapping and neck stretching passed through the flock; then they all settled back into the water and swam off rapidly, only to stop suddenly and all turn to preening and sleeping.

DISPLAY

A drake and two ducks on the lagoon on 24 June courted for about fifteen minutes when they first arrived and again in the late evening of 25 June. We did not see them feed.

The ducks did much more inciting than the drakes did courtship (Figure 4). The duck stretched her neck and bill forward and up as if there were a bubble in her throat, whether the drake did anything or not. The drake's chief action was a preliminary stretching up of his neck, reaching forward, then forward and down, and finally pulling his head in to pat his breast repeatedly (Figure 4). The pats came about two a second. Another action consisted of tipping his bill downward and holding it at that angle, thrusting it forward with such violence that his tail bobbed out of water and the curls of the scapular feathers trembled. Then he drew his head back to his breast and his tail went back down. He followed this with breast patting. When he was patting his breast with his bill, he gave a dove-like moan: *gug gug gugguggug groooooooooo*. Soper (1946) and Höhn (1947) describe this same note. A common gesture of the drake was to lift his breast out of water and tread water, wagging his head ponderously. Another less common action was to stretch head and bill out and upward while slightly extending his 'wrists.' Höhn (1957) described the courting movements discussed here as gulping, rocking, and head rotating.

The Eskimos reported that King Eiders very rarely nest on Bylot Island. Tuck (1959) reports King Eider as a common nesting species along Navy Board Inlet in 1957. Ellis (1956) reported them in numbers at Button Point in 1955.

MASSACHUSETTS AUDUBON SOCIETY, CONTRIBUTION NO. 34 OF THE HATHEWAY SCHOOL, SOUTH LINCOLN, MASSACHUSETTS. JULY 25, 1960.

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REVIEWS

Most reviewers may be identified on the inside front cover of this issue. The affiliation or address of other reviewers follows the author's name.

Indian Legends of Canada

By ELLA ELIZABETH CLARK. Toronto, McLelland and Stewart, 1960. 117 p. $4.50.

This anthology will delight teachers and others who have lamented the difficulty of finding a collection of Indian folklore that would be at the same time authentic, cognizant of the variation in tribal custom and belief, and suitable for the use of young people.

Miss Clarke, of the English Department, Washington State College, has sifted through the published and unpublished folklore of thirty tribes, representing nine linguistic groupings, and from a vast quantity of material (all carefully listed in a bibliography, which students may find useful also) she has selected ninety legends. There are creation and origin myths, animal and other nature stories, historical and personal narratives, ranging from prehistoric days to the coming of the white man. The variety of theme precludes monotony, and gives valuable insight into the range of Indian philosophy.

The author has, she says, "excluded stories with brutal or erotic themes" to make the book suitable for reading in homes and schools. Such censorship is certainly desirable in children's literature. But one could wish that Indian legends were not always relegated to the class of nice harmless reading for the kiddies, that just once the careful exclusion of "brutal and erotic themes" might be dispensed with, and these folk tales presented as the magnificent, colorful, adult things many of them really were – and *are;* for despite the bland assumption to the contrary, the art of storytelling still lives in many tribes, though it is not displayed to casual visitors.

One feels that the choice of Plains Indian material is less fortunate than that representing other areas. The Blackfoot stories certainly do less than justice to the folklore of that dominant confederacy. One would have liked to see more Cree tales also, and a writer more familiar with the history and traditions of the area would probably have discarded some of the material obtained from Stoney sources. But though these points may detract from the work in the eyes of western readers, they do not lessen its general value.

It is a matter for regret, also, that a book so potentially useful to school children, and others could not have been printed in a less eye-straining type than that used. This reviewer at least found it most tiring to read.

Publication was subsidized by the Canada Council, which has thereby rendered a service to all of us, for the Indian folklore is truly Canadian folklore. All other has at least its root, and often part of its growth, in some other soil. And if the original inhabitants of the country are ever going to advance from their present role of white-man's-burden-cum-museum exhibit, and take the place they should in our society, it is essential that their pride in their own cultural heritage be restored, and an appreciation of the genuine beauty and value of that heritage inculcated in the white populace. Books such as this help to achieve that purpose.

FRANCES FRASER
High River, Alberta

Plants of Prince Edward Island

By DAVID S. ERSKINE. Ottawa, Queen's Printer, 1960. 270 p. $1.50.

This flora is a worthy addition to a growing list. Prince Edward Island must now rank as the province with its native plants best known and mapped. After careful study and field work of two summers, a total of 940 species, 82 varieties

and 14 hybrids are admitted. Of the species, 316, or over one third, are introduced.

The book is well written and has an attractive cover. A history of the earlier botanical investigations is given and all earlier records are brought together and evaluated. The main associations are described, with excellent pictures. "Perhaps nowhere else in the world," says the author, "do the daisies grow in as great profusion to brighten the landscape."

The small number of species and the local distribution of many of them is attributed to their recent introduction and the lack of variation in habitat. Only one or two species are not represented in either Nova Scotia or New Brunswick, although many in the adjacent areas were not found on the Island.

Common names are rarely given; and the lack of an index to the genera will handicap any local botanist who tries to use this book with one of the popular pocket guides. Descriptions and keys are not included since they are available in other books. This manual presents a good description of the vegetation along with an interesting discussion of the plant distribution. The notes on the species and the 809 maps on the facing pages, showing the distribution of the collections and sight records, will be indispensable to anyone working on the flora of eastern Canada.

A. E. ROLAND
Department of Agriculture and Marketing
Truro, Nova Scotia

A Gathering of Shore Birds

By HENRY MARION HALL. Edited by Roland C. Clement. Illustrated by John Henry Dick. New York, Devin-Adair, 1961. 242 p. $10.00.

Henry Marion Hall's lively writing, vivid imagery, and long field experience with the shore birds are combined to make this handsome book enjoyable reading indeed. For dyed-in-the-wool shorebird enthusiasts he recalls poignantly many a familiar sight and sound as the birds swarm over beach or mudflat, and his infectious enthusiasm is sure to quicken the interest of others less familiar with this fascinating group of birds.

The greater part of the book is devoted to deftly written popular accounts of 57 shore-bird species that breed in North America. At the end of each there is a section giving field recognition characters, range, and local names, including those used in Spanish-speaking countries of the Western Hemisphere and in Great Britain. Other chapters are made up of annotated lists of the South American species; American species that have visited Europe; European visitors to North America; and finally Siberian visitors to this continent.

Conservation is one of the important themes of the text; focus is on factors that have adversely affected shore-bird numbers in the past and on those likely to affect them even more seriously in the future.

Roland C. Clement's editorial work and complementary writing add greatly to the book. His 16-page introduction to the shore birds (Chapter 1) is particularly informative and thought provoking. John Henry Dick's 95 pen-and-ink illustrations are gems that decorate the book from cover to cover. This beautifully gotten-up book is sure to fulfill a dual purpose of being both useful and highly enjoyable.

W. EARL GODFREY

A Manual of Common Beetles of Eastern North America

By ELIZABETH S. DILLON and LAWRENCE S. DILLON. Evanston, Illinois; Row, Peterson and Co., 1961. 884 p. $9.25.

For many years there has been a need for a general book on the common beetles, especially one to stimulate the interests of amateurs. How well this manual fills the bill remains to be seen, but considering the limited number of species (1,200 out of 10,000) that could be conveniently included and the large area covered (east of the 100th meridian), the Dillons have done an excellent job.

The usefulness of the book is enhanced not only by an illustration of each species, but also by a brief diagnosis including size and color opposite each illustration. A convenient millimeter rule is provided for each plate. A fairly comprehensive glossary with easy-to-understand definitions is included.

The serious or professional student will be disappointed by what is missing in this book. In the preface we are told that the work includes 64 of the 109 families and 1,200 of the 10,000 species of beetles. It would have taken only a little more space to include under each genus a brief statement of the total number of species in North America, and to mention the missing genera and families.

References in the bibliography are divided into the following categories: general, ecology, baits and trapping, and techniques; they are also arranged under each family (here 79 families are included) and under the various States and Canada. The amateur will find some of these useful but the advanced student may wonder why certain important references were omitted and many less useful ones included. All of W. J. Brown's papers on Elateridae and Chrysomelidae (except his 1945 paper on food plants and distribution of *Calligrapha*) are omitted. Other omissions, incorrect placing of references, and inclusion of many one- or two-page local lists detract from the value of this section.

The keys are well illustrated and for the most part easy to use. However, there are some weak spots; for example, in the key to elaterid genera, *Alaus* could have been keyed out more easily by the obvious 'eye spots' on the pronotum; *Ctenicera* do not have the metacoxal plates abruptly dilated (compare Figures 236 and 253); *Conoderus* has only the fourth tarsal segment lobed; and couplet 15 should really have been placed between couplets 7 and 8.

Most of the scientific names are up to date. The few mistakes could have been avoided; for example, in the elaterids, *Lacon* not *Lepidotus* is correct, and *Negastrius* should have been used for *Hypolithus*. No attempt has been made to give any synonymy, probably correctly so for a book of this nature. Nevertheless, a brief statement here and there concerning major changes might have been useful, such as was done on page 573 with the bess beetle. In the elaterids what is now called *Ctenicera* was known for many years as *Corymbites* or *Ludius; Ampedus* used to be called *Elater*.

Most of these criticisms are not very important for the amateur, but will undoubtedly be a drawback for the serious student. All in all, the reasonable price of Dillon's book should make it available to everyone. If it encourages more people to study beetles then the Dillon's have certainly done a service to the advancement of coleopterology.

EDWARD C. BECKER
Entomology Research Institute
Ottawa, Ontario

Penguin Summer

By ELEANOR RICE PETTINGILL. New York, Potter, 1960. 197 p. $5.00.

The Falkland Islands are unusual in several respects. As Dr. Pettingill remarked in explaining his urge to visit them, they are "the only place in the world where we can live with people and still be near three kinds of penguins." To North American naturalists in general they are of particular interest because of their curiously mixed fauna and flora.

During the Pleistocene glaciations the Falklands were connected with South America; and during these glaciations the climate along the mountains of tropical America was sufficiently cool to allow temperate plants and animals to cross the tropic barrier. In consequence the islands possess plants and animals closely related to, or occasionally identical with, some that we know in Canada, in addition to those typical of the southern hemisphere. Thus we have a familiar sedge, generally called *Carex paupercula* in our manuals, which seems to be identical with *C.*

magellanica of Tierra del Fuego and the Falklands. In this book we meet some birds that are in the same category: the Short-eared Owl, Black-crowned Night Heron and close relatives of our Robin and House Wren.

This is Mrs. Pettingill's account of a summer in the Falklands, which she and her husband spent under contract to Walt Disney Productions. The penguins tend to steal the show, as penguins will; but the narrative gives us an excellent introduction to the islands and their people, and to the weather, of course—not really the worst in the world, but probably about as bad as one can find in a latitude as low as 52°, and certainly a shock to anyone coming unacclimatized from the northern summer. The story is well told and profusely illustrated. Maps in the end papers show the places visited, and an appendix gives the scientific names of the plants and animals mentioned in the text. All in all it is a charming account of a strenuous project.

D. B. O. SAVILE

Wonders of Rocks and Minerals

By RICHARD M. PEARL. New York; Dodd, Mead; 1961. 63 p. $3.50.

The author, who is Associate Professor of Geology at Colorado College, has been a collector of minerals and rocks practically all his life and has received awards from organizations on four continents. He has written numerous books and articles including *1001 Questions Answered About the Mineral Kingdom.*

The present volume is designed for the amateur collector, particularly the young collector, who is beginning his study of this fascinating subject. It tells the difference between minerals and rocks, describes some of the more important varieties of each, how and where to collect specimens and how to add to and display collections. The volume is well illustrated and ends with a rock and mineral quiz.

F. J. ALCOCK
Former Director
National Museum of Canada

Hummingbirds

By CRAWFORD H. GREENEWALT. New York, Doubleday, 1960. 250 p. $22.50.

This is not a formal review, but a spontaneous appreciation of a technical and artistic triumph. I understand from the author that this book is also unexpectedly proving to be a financial success for its sponsors, the American Museum of Natural History, the first edition having been quickly sold out.

The author enlisted the aid of specialists in developing new photographic equipment. By devoting every possible weekend and vacation for five years he succeeded in photographing most of the world's hummingbirds. This book contains a selection of these exquisite portraits, together with chapters on general characteristics, iridescence, flight, and the equipment employed. What started out as a photographic study quickly broadened, and Mr. Greenewalt eventually elucidated or confirmed many details of the flight of hummingbirds and also fully explained, for the first time, the mechanism of their iridescence. These subjects are dealt with in simple terms in the book, the mathematical treatments having been given in separate papers.

The illustrations set a new standard both in color reproduction and in definition, the latter being largely due to achieving an exposure time of thirty millionths of a second at an aperture of f32. The motion of the wings is stopped so perfectly that the photographs have a remarkable quality, somewhat suggestive of a Japanese print. However, no description could do them justice.

Although most of us in our hobbies cannot command the financial resources that went into these studies, yet the scientific and artistic results that the author has achieved surely provide a lesson to all of us. Mr. Greenewalt developed his hobby out of enthusiasm and the discipline of his training in engineering. Many hobbies require no more equipment than that to yield profuse dividends. Although the five years that

he spent on his project must have been strenuous, it is doubtful whether the president of a great corporation could find a surer way to avoid the maladies that proverbially beset busy executives.

D. B. O. SAVILE

The Lawn Book

By ROBERT W. SCHERY. New York, Macmillan, 1961. 207 p. $5.95.

Dr. Robert W. Schery has long been recognized as one of the foremost authorities on turf in the United States. He is one of the most prolific writers on the subject of lawn construction and maintenance. It is encouraging to see that he has finally published a book which makes available to the lawn owner a great deal of his vast fund of knowledge concerning the various problems associated with lawn culture. It is fortunate that this information becomes available at a time when interest in turf is at an all-time high.

Dr. Schery's book covers the whole field of lawn making and care. Included are the selection of species, which he describes in the opening chapters making no secret of his well founded admiration for natural Kentucky blue grass, the preparation of the seed bed, the use of lime, fertilizer and soil amendments, methods of planting, and pre-emergence and post-emergence care. Among the items on lawn maintenance are watering, fertilizing, mowing and the control of weeds, diseases, insects and other pests and disorders in turf. All aspects are treated from the regional viewpoint when such information is pertinent. Of particular interest are sections at the conclusion of each chapter in which the author dispels many of the popular misconceptions concerning lawn culture. The publication is abundantly illustrated with photographs, maps, tables and line drawings of lawn grasses and weeds, all of which assist in understanding the well written text.

The Canadian reader may experience some difficulty at first in sorting out the information applicable to conditions in this country but as reading progresses he will find that the text follows a clearly defined pattern and the pertinent information can be secured more readily. All of the author's recommendations concerning procedures for the Northern United States are equally suited to Canadian conditions. The book is a valuable contribution to the not too abundant literature on turf culture.

J. H. BOYCE
Turf Specialist
Plant Research Institute
Ottawa, Ontario

The Friendly Evergreens

By L. L. KUMLIEN. Toronto, Rinehart, 1954. 237 p. $11.00.

This is a friendly book. The author presents several articles on various aspects of his subject and by this means a lot of information to stimulate interest in and enjoyment of evergreens.

Mr. Kumlien is not a botanist. His book cannot be considered primarily technical. He is, however, a nurseryman, and his long years of association with evergreens have enabled him to express the particular fondness he has come to have for a type of plant that lends stability and permanence to a constantly changing scene. He gives good advice on transplanting and on managing seedlings and plants in their later stages of growth. Lists according to type of form provide the home owner with valuable information. Although the book does not contain a key, the good line drawings of the foliage of each genus give definite help in identification.

"Descriptions of Varieties" is naturally the largest section. The colored illustrations are, unfortunately, poorly printed, but the text convinces the reader of how intimate is the author's acquaintance with his subject. This section in itself is enough to prove that Mr. Kumlien achieves his aim: to lead many lovers of nature into a little better understanding of the friendly evergreens.

ROBERT A. HAMILTON

Bird Mortality in the Dutch Elm Disease Program in Michigan

By GEORGE J. WALLACE, WALTER P. NICKELL, and RICHARD F. BERNARD. Bloomfield Hills, Cranbrook Institute of Science, 1961. 44 p. $1.00 (Bull. Cranbrook Inst. Sci. 41)

This report outlines the very high mortality of small birds, mainly robins, which followed a program of DDT spraying to control bark beetle vectors of the Dutch elm disease. It is typical of many recent studies of the unwanted results of the use of highly toxic insecticides. We need to know a great deal more ecology before we can use those materials to get *only* the desired result. Suggestions are offered to reduce bird mortality in spraying for insect control.

VICTOR E. F. SOLMAN

The Living Land

By RODERICK HAIG-BROWN. Toronto, Macmillan Co. of Canada, 1961. 269 p. $7.50.

The Living Land — with its earth-colored dust jacket, its 9-by-11-inch size, its generally excellent photographs, maps, charts, diagrams, sketches and art work — is a most impressive book. In its pages are distilled the major ideas, facts and conclusions derived from almost four thousand pages of transactions of twelve annual British Columbia Natural Resources conferences.

Add to those distinctions the fact that its author is a long-time resident of British Columbia, by choice rather than by birth, that he has been in the forefront of those asking for, yes, demanding, more far-sighted management of renewable resources and you realize what an impact the book will have on thinking in the resource field. The book, the first one to use paper made in the Province of British Columbia, is printed in beautiful, clear, largely error-free type and is well made.

The text, in 10 parts containing 27 chapters, deals with land, soil water and climate, forest resources, agriculture, energy, commercial fisheries, mining, recreation, pollution and transportation, and people.

The history of the province and the early wasteful use of resources are reviewed briefly.

In the review of the forest resources the whole matter of sustained yield and of changing technology over the past 70 years are covered. A key idea of major importance is expressed in one sentence. "Forest land can yield a hundred crops of wildlife and a hundred years of recreation while it is growing one crop of trees." That sentence expresses the highest ideal of integrated multiple use of renewable resources.

The largest section deals with recreation. That is appropriate since "recreation fills a very large part in the life of mankind and covers an almost infinite variety of activities and interests. . . . Philosophers of recreation believe that such things are so much a part of man's being that he cannot live fully or even comfortably without them. The whole history of man, his art and his culture, suggests they are right. Arising out of this is the proposition that today's intense and growing demand for outdoor recreation reflects the suppression of this aboriginal need in an increasingly urban civilization."

In the chapter on wildlife, the illustrations of mammals do not do justice either to the species depicted or to the remainder of the book. A fine set of flower photographs is marred by transposition of two captions. The review of game management techniques is timely but not exhaustive.

The British Columbia resident now has at hand a source book of information that supplements the geographic presentation in the *British Columbia Atlas of Resources*, which was produced in 1956. As the *Atlas* was the first publication of its kind for a province or state so is *The Living Land* a unique and pioneering text. It is sincerely hoped that other provinces will follow this fine example so that their

citizens may be informed of the realities of their resources and of the conflicting demands that will be made upon them by an expanding population, with increasing leisure.

VICTOR E. F. SOLMAN

OTHER NEW TITLES

Annual Report for 1960 of the Denver Museum of Natural History. Denver, Colorado. 54 p.

Dusky and Swallow-tailed Gulls of the Galapagos Islands. By ALFRED M. BAILEY. Denver Museum of Natural History, 1961. 30 p. $1.00 (Museum Pictorial No. 15)

Letter to the Editor

In his review of "The Kirtland's Warbler" in The Canadian Field-Naturalist, Vol. 75, No. 1, p. 47 (January-March 1961), Dr. Savile stated that a heading on page 78 was wrong. Lest some readers be prompted to change their copies, I wish to assure them the heading, "Percentage of nests," and figures on that page are right as given in the book. For those who wish to make corrections, however, I draw attention to Table 10, p. 95; the longest period on the nest for nest 47-12 should be 61 minutes.

HAROLD MAYFIELD

Waterville, Ohio

NOTES

Notes on Some Mammals of the Gaspé Peninsula, Quebec

SOUTH of the Gulf of St. Lawrence, the easternmost extension of the Province of Quebec is the Gaspé Peninsula, a rugged area of some 9,000 square miles comprising five counties. Settled in the seventeenth century, it remains relatively undeveloped; fishing, agriculture and logging, largely along the periphery, are the principal industries. Interest in the local mammals is reflected in such current place names as Cap au Renard and Cap à la Baleine, Baie des Sables, L'Anse de Loutre, Ruisseau Castor, Lac Vison, Rivière du Loup and Rivière à la Marte. The unusual geological background of the region, together with the central spine of the Shickshock Mountains rising to 4,300 feet and the lands to the west somewhat isolated by the Matapédia Valley, gives the peninsula a special appeal to the zoogeographer.

Mammals were first systematically collected here by Thaddeus Surber in 1900, but unhappily his collection of some 30 species was burned, although some of his notes were preserved by Elliot (Publ. Field Col. Mus. 54, Zool. Ser., 3 (3): 15-29, 1901). Mammals were collected on several subsequent expeditions to the area; reports are capably summarized by Cameron (Bull. nat. Mus. Canada 128: 168-188, 1953). In 1959 I visited the Gaspé Peninsula from 4 to 10 August, traveling the coastal highway in clockwise fashion. Severe forest fires in the interior prevented my visiting the mountainous Gaspesian Park area. Some collecting (154 trap-nights) was done at three sites. Thirteen specimens were taken, all deposited in the U.S. National Museum, Biological Survey collection (No. 288003-288015). Below are notes on eight species not previously recorded or here reported from new localities.

Sorex fumeus umbrosus Jackson. Two smoky shrews were collected, one at the edge of a meadow at Ste. Félicité, Matane Co., the other in spruce-fir forest at Cap des Rosiers, Gaspé South.

Blarina brevicauda angusta Anderson. One short-tailed shrew was taken 2 mi. west of Coin du Banc, Gaspé South, in a white cedar and sphagnum swamp.

Marmota monax (Linnaeus). Woodchucks have been reported as uncommon on the Gaspé Peninsula. I noted burrows in fields near Ste. Anne des Monts, Gaspé North; Percé, Gaspé South; and St. Jean L'Evangéliste, Bonaventure Co.

Synaptomys cooperi cooperi Baird. Two adult male bog lemmings were col-

lected in a cedar swamp near the Rivière Portage, 2 mi. west of Coin du Banc, Gaspé South. To my knowledge, this species has not been reported previously from the eastern end of the Gaspé Peninsula.

Clethrionomys gapperi gaspeanus Anderson. Four red-backed voles were taken in a spruce-fir forest at Cap des Rosiers, Gaspé South. Two were juveniles; the adults were both females, one lactating (and with two botfly larvae in the inguinal region) and the other carrying five 9-mm embryos. An adult male was taken in a cedar swamp 2 mi. west of Coin du Banc. Cameron (quoted work) considers the race *gaspeanus* as indistinguishable from *ochraceus.*

Napaeozapus insignis gaspensis Anderson. A lactating woodland jumping mouse was taken among alders and bracken along the Rivière Portage, 2 mi. west of Coin du Banc, Gaspé South. She was parasitized by one *Cuterebra* larva in the pectoral region. This mouse exhibited the orange coloration on the sides ascribed to *gaspensis;* presumably this was not an adventitious trait due to contact with water, for she was taken on a bank some 10 feet above the level of the stream.

Mustela vison Schreber. Trappers take the mink regularly, but precise localities are vague and the species is regarded as scarce on the north shore of the peninsula. One was seen at close range by my son, Albert M. Manville, while fishing in the Rivière Portage, 2 mi. west of Coin du Banc, Gaspé South.

Mephitis mephitis (Schreber). Two striped skunks, killed by traffic, were seen near Anse aux Gascons, extreme eastern Bonaventure Co., on 9 August. Skunks have been reported as rare or absent at the eastern tip of the peninsula.

RICHARD H. MANVILLE

Fish and Wildlife Service
U.S. National Museum
Washington 25, D.C.
29 January 1960

A Manitoba Occurrence of the Black-headed Grosbeak

THE SOUTH SHORE of Lake Manitoba is paralleled by a fringe of forest stretching between the lake and wide marshes. Mr. and Mrs. Rowley Frith, Mrs. Lloyd and I were traveling by car through this wooded tract westward from Delta, Manitoba, on August 31, 1959, and we were watching for birds along the trail side. In an area of bushes and low trees we saw strange birds, stopped to investigate, and found a small group of Black-headed Grosbeaks *Pheucticus melanocephalus* (Swainson)—five, according to my roll book, but there may well have been more. They were easily identified by field glasses at a distance of 25 or 30 feet.

On looking up the range of the species in the A.O.U. checklist I found that Manitoba was not included and that the species was not recorded in Canada east of Maple Creek, Saskatchewan, which is far to the west of our location. The National Museum range map shows one previous Manitoba record, a singing male, at Treesbank, observed by Norman, Stuart, and Talbot Criddle on May 30, 1919 (Can. Field Nat. 35:134, 1921).

HOYES LLOYD

582 Mariposa Avenue
Ottawa 2, Ontario
3 March 1960

A Loon's Nest with Three Eggs

ON JULY 6, 1947, an employee of Fraser Companies Limited found a nest of the Common Loon, *Gavia immer,* on a small island in Third Lake, Green River watershed, Madawaska County, New Brunswick. This nest contained two eggs. On July 16 my wife and I visited the nest, which then held three eggs. Only one pair of loons was noted in the vicinity.

In his *Life Histories of North American Diving Birds,* Bent (1919), stated that he personally had no records of a loon's nest with three eggs. Jourdain in *A Prac-*

tical Handbook of British Birds (Vol. 4, 1958) says "Eggs – normally two: occasionally one or rarely three (Canada)."

The only definite reference to a three-egg nest of which I am aware is to one at Birch Lake, Minnesota (Olson and Marshall, Occ. Pap. Univ. Minn. Mus. nat. Hist. 5:47, 1952).

GEORGE F. BOYER
Canadian Wildlife Service
R.R. 2
Maple, Ontario
25 March 1960

[Editor's note: Sad word has been received of the death of Mr. Boyer on October 20, 1960.]

A Range Extension of The Four-toed Salamander in Eastern Canada

IN RECENT years the ranges of most amphibians known to occur in eastern Canada have been extended to the north and east, often by several hundred miles. These range extensions have been summarized by Bleakney (A zoo-geographical study of the amphibians and reptiles of Eastern Canada. Bull. nat. Mus. Canada 155, 1958). Most of them are almost certainly not due to the physical extension of the animals' ranges but reflect inadequate collecting and inadequate reporting in past years.

On August 24, 1959, a salamander identified as *Hemidactylium scutatum* (Schegl) was taken under a leaf near a temporary pool on the side of Mount Johnson at an altitude of 275 feet. Mount Johnson is 23 miles east-southeast of Montreal, near the city of St. Jean, Iberville Co., Province of Quebec, at approximately 45°10′N 73°12′W. The specimen has been deposited in the National Museum of Canada as No. 4218.

The location of this collection is 120 miles east of the Gleneagle, Quebec, record (Gorham, S. W., Can. Field Nat. 69:167, 1955) and about 125 miles north of the location of the northern limit for this species east of the great lakes as shown by Conant (A field guide to the reptiles and amphibians. Boston, Houghton Mifflin, 1958) The find is of some significance since it is the first collection from the great St. Lawrence lowlands plains, where there occurs a wealth of suitable habitats, and the station lies almost exactly midway between the location of the easternmost records north of the St. Lawrence River and the Main records. Bleakney (Copeia 1953: 180) suggested that this salamander is probably relatively common in southeastern Canada. The subsequent Gleneagle record and the present Mount Johnson record amply confirm his view. The critical gap between the western New York State and the Maine records on Conant's map may now be filled in with confidence.

I am indebted to Dr. Irma Schnooberger, Flint Junior College, who made the capture and to Mr. Stanley W. Gorham, F.Z.S., National Museum of Canada, for the identification.

NORRIS S. DENMAN
Aluminum Company of Canada Limited
Box 6090, Montreal 3, Quebec
1 February 1960

Dr. Oliver L. Austin, Jr., Curator of Birds, the Florida State Museum, has been appointed by the Nuttall Ornithological Club, Chairman of the Bent "Life Histories of North American Birds" Committee.

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Webster's New International Dictionary is the authority for spelling. However, in a case of difference in the spelling of a common name, and in the use of a variant name, a decision of a learned society is preferred.

References are made by the author-date system. They should be listed alphabetically and typed at the end of the main body of text. For titles in reference matter, abbreviations follow the rules in the *International Code for the Abbreviation of Titles of Periodicals* and the *World List of Scientific Periodicals*.

Other abbreviations should be used sparingly. The better-known terms of measurement follow CSA Specification Z85-1943 *Abbreviations for Scientific and Engineering Terms* or the equivalent of the American Standards Association (Z10.1-1941).

Tables should be titled and numbered consecutively in arabic numerals. Tables and legends for the figures should be placed after the list of references. Each table and all the legends should be on separate pages.

Notes should bear the name of one author only and references in notes should be incorporated directly in the text.

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HELP REQUESTED
IN
INVESTIGATION OF THE BALD EAGLE

Your help is requested in an investigation of the bald eagle. Alarmed by persistent disquieting reports of a downward trend in the population of bald eagles, the National Audubon Society in the United States announced in November a continental study aimed at determining the status of the species. The project, a co-operative one, is designed to cover at least five years.

Canadian Audubon Society has undertaken to gather data in this country, as its contribution to the continental project.

Though serious declines in the numbers of bald eagles have been reported in various areas, no one is able to say what is happening to the species throughout its North American range, or even to guess how many bald eagles survive. It follows that inventory is the first essential step. Once numbers have been closely estimated, reproductive success measured, and nesting and wintering concentrations and migration patterns mapped, future checks will then disclose population trends.

Intensive research into the eagle's ecology and habitat needs will follow the extensive survey. These studies should point a sound course for future conservation efforts, just as the National Audubon Society's research under Robert Porter Allen (now retired) laid the groundwork for the present broad effort, involving many agencies, to save the whooping crane. The eagle program will be under the direction of Mr. Allen's successor, Alexander Sprunt IV.

The first part of the study—the inventory based on the number of active nests—will get under way immediately. It will be undertaken through the medium of a mailed questionnaire now available from this society's Toronto headquarters. It is hoped that the co-operation of a sufficient number of people can be enlisted to insure an adequate coverage of Canada. We have no illusions about the scope of this task. To succeed we shall need the co-operation of federal and provincial wildlife agencies throughout the country, as well as provincial and local natural history organizations and ornithological societies. We shall also need public understanding and support.

We now earnestly solicit your assistance. If you have Canadian information on active eagle nests or wintering concentrations, feeding areas, or any other facets of eagle biology, please write:

CANADIAN AUDUBON SOCIETY

423 SHERBOURNE STREET TORONTO 5, ONTARIO

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NEW PLANT RECORDS FOR SOUTHWESTERN DISTRICT OF MACKENZIE

JOHN W. THIERET
Chicago Natural History Museum, Chicago, Illinois

AMONG the plants collected in southwestern District of Mackenzie during the 1958 and 1959 Northern Great Plains Botanical Field Trips sponsored by Chicago Natural History Museum are specimens representing either unrecorded taxa from the area or significant extensions of known range. These records are summarized in this paper. The collection numbers cited are those of the author. Numbers 4000 to 4380 were collected in August 1958 with the assistance of Chester E. Hansen; 4500 to 6175 were collected during the months of June, July and August, 1959, with the assistance of Robert J. Reich. Collections were made along the section of the Mackenzie Highway in the Northwest Territories; along the Enterprise–Mackenzie River Highway (first 82 miles of the Yellowknife highway) and the road therefrom to Kakisa Lake; along the first 17 miles of the Mackenzie River–Fort Rae highway; along Kakisa River and at Kakisa Lake; at Hay River town; and in the vicinity of Fort Providence. All specimens are in the herbarium of Chicago Natural History Museum (F).

The all-too-scanty knowledge of the flora of southwestern Mackenzie is on record in relatively few publications. Raup (1947), in his *Botany of Southwestern Mackenzie*, brought together information available to that time. Since then, most additions to the flora have been made by Cody (1957, 1961). Helpful works that, at least in part, treat plant distribution in contiguous areas are those of Cody (1960), Porsild (1943), and Raup (1935, 1936).

In the catalogue below, the arrangement of the families is based on the Englerian system. Genera are placed in alphabetical order with the families, and species are arranged alphabetically within each genus. Specimens are cited by brief data to indicate locality and by collection number. Localities given by mile alone (e.g., mile 24) refer to the Enterprise–Mackenzie River highway.

POLYPODIACEAE

CYSTOPTERIS MONTANA (Lam.) Bernh. Black spruce—white spruce forest above Kakisa River 1½ miles below Lady Evelyn Falls, *5350*.

Second record with exact locality data for southwestern Mackenzie. Our collection extends the southwestern Mackenzie range of this species some 200 miles eastward from the Nahanni Mountain collection cited by Raup (1947). Not reported from Great Slave Lake.

GYMNOCARPIUM DRYOPTERIS (L.) Newm. (*Dryopteris disjuncta* [Ledeb.] Mort.; *D. linnaeana* C. Chr.; *Thelypteris dryopteris* [L.] Sl.) Limestone crevices on escarpment in white spruce forest, mile 15½, *5156*.

Second record for southern Mackenzie, representing a range extension of some 350 miles east-southeast from the Brintnell Lake station cited by Raup (1947). Recorded from Lake Athabaska and Great Bear Lake but not Great Slave Lake (Raup, 1936).

Mailing date of this number: 15 August 1961

EQUISETACEAE

EQUISETUM VARIEGATUM Schleich. Beach of Kakisa Lake near outlet, *6096*.

Not previously recorded in the area bounded by Great Slave Lake (eastern arm) and central Wood Buffalo Park on the east and the Mackenzie Mountains on the west (Raup, 1935, 1936, 1947).

LYCOPODIACEAE

LYCOPODIUM COMPLANATUM L. Jack pine — trembling aspen forest, mile 11½, *4835*.

Not previously recorded in the area bounded by the eastern arm of Great Slave Lake and central Wood Buffalo Park on the east, and Fort Liard and Nahanni Mountain on the west (Raup, 1935, 1947).

SELAGINELLACEAE

SELAGINELLA SELAGINOIDES (L.) Link Black spruce forest along Kakisa Lake road 1½ miles south of junction with Enterprise — Mackenzie River highway, *4977;* black spruce forest, mile 57½, *5217*; shrub zone, marly lake, mile 64, *6053a*.

First records for southern Mackenzie east of the mountains. The nearest station cited by Raup (1947) is at Nahanni Mountain, some 200 miles to the northwest of our localities. Known at Lake Athabaska (Raup, 1936) and Great Bear Lake (Porsild, 1943) but not at Great Slave Lake.

SPARGANIACEAE

SPARGANIUM ANGUSTIFOLIUM Michx. In water, roadside ditch, mile 10¼, *5578*; mud and shallow water along Kakisa River, 2½ miles below highway bridge, *5710*; along creek, mile 23½, *5775*.

First record for southwestern Mackenzie. Known at Great Bear Lake (Porsild, 1943) and from the eastern arm of Great Slave Lake (Raup, 1936).

NAJADACEAE

POTAMOGETON GRAMINEUS L. var. MAXIMUS Morong Kakisa Lake at outlet, in water, *5634*; rapids along Kakisa River 4 miles below highway bridge, *5702*.

First record of this variety from southwestern Mackenzie. Reported by Raup (1947) from Wood Buffalo Park and from Great Bear Lake.

POTAMOGETON VAGINATUS Turcz. Kakisa Lake at outlet, in water, *4615*, *5675*.

First record for southwestern Mackenzie. Reported from Wood Buffalo Park and Great Bear Lake (Raup, 1947).

JUNCAGINACEAE

TRIGLOCHIN MARITIMA L. Rocky slope, island in Mackenzie River 1 mile west of Fort Providence, *4134;* Beach of Kakisa Lake just west of outlet, *4611;* marshy area, mile 59½, *5222;* among sedges, marly lakes, miles 54, *5078*, 63, *5294;* in exposed marl, mile 66, *4260*.

Our records are the second for southwestern Mackenzie and include the first from the Mackenzie River above Norman Wells (Cody, 1960; Raup, 1947). This species is known at Great Slave Lake only from the eastern arm (Raup, 1936).

GRAMINEAE

AGROPYRON TRACHYCAULUM (Link) Malte var. NOVAE-ANGLIAE (Scribn.) Fern. Disturbed soil, ferry landing (south) mile 82, *6011;* grasslands, mile 17, Mackenzie River—Fort Rae Highway, *4136*, *4174*, *4181*.

First record from the Mackenzie River above Norman (Raup, 1947). From southern Mackenzie east of the mountains, this variety has been recorded only at Fort Smith (Cody, 1957).

AGROSTIS SCABRA Willd. Grassland 4 miles northeast of Fort Providence, *4083*.

First record along the Mackenzie River above Norman Wells (Cody, 1960). For Great Slave Lake this species has been reported only from the eastern arm (Raup, 1936).

FESTUCA SAXIMONTANA Rydb. Jack pine forest above Kakisa River 1½ miles below Lady Evelyn Falls, *5467;* disturbed soil along road (east) to ford over Kakisa River, *4969*, *5335;* limestone outcrop, mile 22¾, *5174*.

First records for southwestern Mackenzie. Known from Lake Athabaska, the eastern arm of Great Slave Lake, and from Great Bear Lake (Raup, 1936).

HELICTOTRICHON HOOKERI (Scribn.) Henr. (*Avena hookeri* Scribn.) Limestone outcrops, miles 13½, *5573*, *5574*, 21½, *5615*, and 22¾, *5161*.

New to the flora of District of Mackenzie. Reported by Raup (1936) from a prairie at Peace Point in Wood Buffalo Park, Alberta, from which site our collections represent a range extension of some 200 miles to the northwest.

KOELERIA CRISTATA (L.) Pers. Limestone outcrops, miles 13½, *5570*, *5571*, 21½, *5608*, 22¾, *5162*, 24, *5126*, 25, *4944*, 26, *5534*, and 28½, *4919*.

New to the flora of District of Mackenzie. Reported by Raup (1936) from Wood Buffalo Park, Alberta, west of the upper Slave River, from which site our collections represent a range extension of some 200 miles to the northwest.

MUHLENBERGIA GLOMERATA (Willd.) Trin. var. CINNOIDES (Link) Herm. In peaty-marly soil, mile 66, *4259*, *6047;* in shrub zone around marly lake, mile 50, *5718;* among sedges, marly lake, mile 44½, *6113*.

New to the flora of District of Mackenzie. The nearest record that I have been able to find for this species is that of Moss (1953) from near Smith, Alberta, some 400 miles to the south of our localities.

MUHLENBERGIA RICHARDSONIS (Trin.) Rydb. (*M. squarrosa* (Trin.) Rydb.) Rocky slope, island in Mackenzie River 1 mile west of Fort Providence, *4125;* in crevices of limestone bluff, Alexandra Falls on Hay River, *6155;* grassland, mile 17, Mackenzie River — Fort Rae highway, *4191;* in sedge-shrub community over marl, mile 20, *5763;* at edge of marly lake, mile 50, *5397*.

Our collections include the first record of this species from the Mackenzie River. Previous records in the District of Mackenzie are only two: Fort Smith (Cody, 1957) and Bear River (Porsild, 1943).

ORYZOPSIS ASPERIFOLIA Michx. Jack pine forest above Kakisa River at highway bridge, *4741;* white spruce-jack pine-trembling aspen forest above Kakisa River at highway bridge, *4775*; black spruce-jack pine-larch-trembling aspen forest along road to Kakisa Lake, ¾ mile from junction with Enterprise — Mackenzie River Highway, *4684*.

New to the flora of District of Mackenzie. Our collections represent a range extension of some 300 miles northwest of what seems to have been the known northern limit of this species, the mouth of the Firebag River south of Wood Buffalo Park (Raup, 1936).

ORYZOPSIS PUNGENS (Torr.) Hitchc. Disturbed soil, miles 1, *4804*, 11, *4824*, 33, *4318*, and 52, *5084;* limestone outcrop, mile 12, *4855;* jack pine forest above Kakisa River near highway bridge, *4742*.

Our collections are the third record of this species from District of Mackenzie. It had previously been recorded from Fort Smith and Fort Simpson (Cody, 1957, 1961).

SCOLOCHLOA FESTUCACEA (Willd.) Link Grassland 4 miles northeast of Fort Providence, *4047*, *4065*.

Second record for District of Mackenzie. Reported by Cody (1957) from Big Island in Great Slave Lake.

TRISETUM SPICATUM (L.) Richt. var. MAIDENII (Gand.) Fern. Limestone crevices, gorge of McNallie Creek, mile 23½, *5134*, *5973*.

In southwestern Mackenzie this variety had been known only from Brintnell Lake in the Mackenzie Mountains (Raup, 1947). It is apparently not yet known from Great Slave Lake.

CYPERACEAE

CAREX BEBBII Olney Disturbed soil, mile 6, *5949*, and along road (east) to ford over Kakisa River, *5332;* limestone outcrop, mile 12, *5585*.

Previously recorded for southwestern Mackenzie only at Fort Simpson (Raup, 1947). Not yet reported for the Great Slave Lake region.

CAREX BUXBAUMII Wahl. Disturbed soil, miles 18, *5598*, and 70½, *6036*; sedge zone, marly lakes, miles 41½, *5421*, 50, *5398*, and 63, *5293;* exposed marl, mile 66, *4258*.

First records for southwestern Mackenzie. In District of Mackenzie reported only from Great Bear Lake (Porsild, 1943) and Indin Lake (Cody, 1957). The latter station is about 250 miles north of our localities.

CAREX CAPILLARIS L. Disturbed soil, mile 10, *4819*.

Previously recorded, in the Great Slave Lake region, only at the eastern arm (Raup, 1936). Our collection is the first record of this species between the eastern arm and the mountains (Raup, 1947).

CAREX CONCINNA R. Br. Disturbed soil, mile 10, *4814*.

Previously recorded, in the Great Slave Lake region, only at the eastern arm (Raup, 1936). Our collection is the first record of this species between the eastern arm and the mountains (Raup, 1947).

CAREX CRAWFORDII Fern. Disturbed soil along road (west) to ford over Kakisa River, *4287*.

First record, with exact locality data, for District of Mackenzie.

CAREX INTERIOR Bailey Sedge and shrub zones, marly lake, mile 61, *5276*.

New to the flora of District of Mackenzie.

CAREX LASIOCARPA Ehrh. var. AMERICANA Fern. Shallow pond and along creek, mile 44, *4303;* on island in Kakisa River 4 miles below highway bridge, *5683;* gravelly-marly

shore and shallow water of lake, mile 40½, *5430;* sedge and shrub zones, marly lakes, miles 50, *5389,* and 61, *5275.*

New to the flora of District of Mackenzie. Reported by Cody (1957) from just south of the N.W.T. border in Alberta near Fort Smith.

CAREX LIMOSA L. Sedge and shrub zones, marly lakes, miles 41½, *5414,* and 61, *5280.*

Previously unreported for southwestern Mackenzie. In southern Mackenzie this species is known from the eastern arm of Great Slave Lake (Raup, 1936) and from Great Bear Lake (Porsild, 1943).

CAREX PRATICOLA Rydb. Grasslands, miles 13-14, *5033,* and 17, *4202,* Mackenzie River—Fort Rae highway.

Second record for District of Mackenzie with exact locality data. Reported by Raup (1947) from Fort Simpson.

CAREX SARTWELLII Dewey Disturbed soil, mile 18, *5600.*

Apparently previously unrecorded for District of Mackenzie. Raup (1935) reported this species from Peace Point in Wood Buffalo Park, some 175 miles south of our locality.

ELEOCHARIS ACICULARIS (L.) R. & S. Beach of Kakisa Lake west of outlet, *5667.*

Previously recorded, in southwestern Mackenzie, only at Fort Simpson (Raup, 1947). Not yet recorded for Great Slave Lake.

ELEOCHARIS PALUSTRIS (L.) R. & S. Shore of Kakisa Lake east of outlet, *5663;* shore of Kakisa River 1½ miles below highway bridge, *5712.*

Only two stations have previously been reported for this species in southwestern Mackenzie: Fort Simpson and Fort Liard (Raup, 1947). It is not recorded from Great Slave Lake.

ERIOPHORUM VAGINATUM L. ssp. SPISSUM (Fern.) Hult. Marsh, mile 43, *4307;* marsh above south shore of Kakisa Lake, *4652, 4678;* stream bed along road (east) to ford over Kakisa River, *4564;* black spruce forest along Kakisa Lake road about 1½ miles from junction with Enterprise — Mackenzie River highway, *4978.*

First records for southwestern Mackenzie. Known in Wood Buffalo Park and on the lower Mackenzie (Raup, 1947).

ERIOPHORUM VIRIDI-CARINATUM (Engelm.) Fern. Shallow water and sedge zone, marly lake, mile 50, *5385.*

First record for southwestern Mackenzie. Recorded for Great Slave Lake only at the eastern arm (Raup, 1936).

SCIRPUS CESPITOSUS L. var. CALLOSUS Bigel. Sedge zone, marly lakes, miles 41½, *5415,* 44½, *5120,* and 63, *5298;* black spruce — larch forest, open, along road to Kakisa Lake ¾ mile from junction with Enterprise — Mackenzie River highway, *4715;* mile 59½, *5225.*

First records for southwestern Mackenzie. On Great Slave Lake, known only from the eastern arm (Raup, 1936).

SCIRPUS VALIDUS Vahl. Beach of Kakisa Lake near outlet, *5650, 5670;* exposed marl, mile 30, *5528, 6145;* marly lake, mile 50, *5391;* beach and shallow water, small lake, mile 61½, *5281.*

Apparently the first records, with exact locality data, from the Great Slave Lake and upper Mackenzie River region above Fort Norman (Raup, 1947).

JUNCACEAE

JUNCUS ALBESCENS (Lange) Fern. Black spruce — white spruce forest along road (east) to ford over Kakisa River, *5320;* disturbed soil, mile 44, *5755.*

Previously unrecorded, in southeastern Mackenzie, east of the mountains. The only other Mackenzie basin record seems to be that of Raup (1936) from the eastern arm of Great Slave Lake.

JUNCUS NODOSUS L. Beach of Kakisa Lake just east of outlet, *5656;* disturbed soil, west channel of Hay River, south of Hay River town, *6126.*

Previously unrecorded with exact locality data, in southwestern Mackenzie, between Fort Smith and Fort Simpson (Raup, 1947).

JUNCUS STYGIUS L. var. AMERICANUS Buch. Among sedges, marly lake, mile 44½, *6114.*

New to the flora of District of Mackenzie. Our collection represents a northwestward extension of some 300 miles from the previous northwesternmost record for this species, Lake Athabaska (Raup, 1936).

LILIACEAE

Tofieldia glutinosa (Michx.) Pers. Marshy area, mile 36, *4314;* among sedges, marly lakes, miles 50, *5383,* and 63, *5296.*

First records, with exact locality data, from southwestern Mackenzie outside the mountains (Raup, 1947). Not yet known from Great Slave Lake although collected in Wood Buffalo Park in Alberta (Raup, 1936).

ORCHIDACEAE

CYPRIPEDIUM CALCEOLUS L. var. PUBESCENS (Salisb.) Fern. Black spruce-white spruce-larch forest along Kakisa River 1½ miles below Lady Evelyn Falls, *4601;* black spruce—larch forest along Kakisa Lake road ¾ mile from junction with Enterprise — Mackenzie River highway, *4712.*

First record, with exact locality data, for the region of the upper Mackenzie River, Great Slave Lake, and Lake Athabaska (Raup, 1947). The nearest station cited by Raup is at Nahanni Mountain, some 200 miles northwest of ours.

SALICACEAE

All our willow collections were identified by George W. Argus.

SALIX GRACILIS Anderss. (*S. petiolaris* Sm.) Grassland 4 miles northeast of Fort Providence, *4107,* and mile 17, Mackenzie River — Fort Rae highway, *4172, 4172a.*

Second record for District of Mackenzie, representing a range extension of some 200 miles northwest from the Fort Smith locality cited by Raup (1947).

SALIX LASIANDRA Benth. var. LANCIFOLIA (Anderss.) Bebb Beach of Kakisa Lake just west of outlet, *4612, 4613;* gravel bar in Kakisa River just below ford, *5183.*

First record of this variety for District of Mackenzie.

SALIX MACCALLIANA Rowlee Grasslands 4 miles northeast of Fort Providence, *4066,* and along Mackenzie River — Fort Rae highway, miles 16, *5034,* and 17, *4160; Salix* zone, small pond, mile 42, *5409;* disturbed soil, mile 54, *4720;* marsh, mile 8, *4812, 4812a.*

Second record for District of Mackenzie. Reported by Cody (1957) from Fort Smith. Our collections represent a range extension of some 200 miles to the northwest.

SALIX PEDICELLRIS Pursh var. TENUESCENS Fern. Shrub zone, marly lake, mile 54, *5072.*

First report of this variety from District of Mackenzie, although it is known in Wood Buffalo Park, Alberta (Argus, in a letter).

SALIX RETICULATA L. Forested slope above Kakisa River 1½ miles below Lady Evelyn Falls, *4606.*

First record between the eastern arm of Great Slave Lake and the mountains (Raup, 1936, 1947).

BETULACEAE

BETULA OCCIDENTALIS Hook. (*B. microphylla* sensu Raup) Grassland, mile 16, Mackenzie River — Fort Rae highway, *5035.*

Not previously recorded in the area between the eastern arm of Great Slave Lake and central Wood Buffalo Park on the east and Nahanni Mountain on the west (Raup, 1935, 1947).

POLYGONUM COCCINEUM Muhl. Shore of Hay River, mile 49, Mackenzie Highway, *4362, 6163.*

New to the flora of District of Mackenzie. Our collections represent apparently a considerable northward extension of the known range of this species. *Polygonum coccineum* is not recorded for the Peace River and Liard River regions (Raup, 1934) or for the Athabaska — Great Slave region (Raup, 1936). Breitung (1957), in his catalogue of Saskatchewan plants, reports it only from the southern portion of that province.

CHENOPODIACEAE

CHENOPODIUM GLAUCUM L. var. SALINUM (Standl.) Boivin Gravel bars in Kakisa River 1½ miles below Lady Evelyn Falls, *5488,* and just above highway bridge, *5745;* on beach of Kakisa Lake near outlet, *5636;* on shore of Kakisa River 3 miles below highway bridge, *5706.*

The only previous record for District of Mackenzie is that of Cody (1960) from Norman Wells, some 425 miles to the northeast. The northernmost Alberta record is from McMurray (Raup, 1936), about 350 miles southwest of our localities.

CHENOPODIUM HYBRIDUM L. var. GIGANTOSPERMUM (Aellen) Rouleau Gravel of road bed, mile 60, *6069.*

New to the flora of District of Mackenzie. Recorded by Cody (1957) from Fort Fitzgerald, Alberta, some 200 miles southeast of our area.

CARYOPHYLLACEAE

ARENARIA DAWSONENSIS Britt. Disturbed soil, miles 4, *5559,* 10, *4815,* 52, *5093,* and 59½, *5227;* drying marl, mile 30, *5512, 5520;* gravel bar in Kakisa River 1½ miles below Lady Evelyn Falls, *5510.*

Previously recorded for southwestern Mackenzie only at Brintnell Lake and Lone Mountain (Raup, 1947). Known from Wood Buffalo Park, the eastern arm of Great Slave Lake (Raup, 1936) and Great Bear Lake (Porsild, 1943).

ARENARIA RUBELLA (Wahl.) Sm. (*A. verna* L. var. *pubescens* [C. & S.] Fern.) Limestone outcrops, miles 12, *4843*, 25, *4947*, and 28½, *4916*.

Previously recorded with exact locality data, from southwestern Mackenzie, only in the mountains (Raup, 1947). Known from the eastern arm of Great Slave Lake and from Lake Athabasca (Raup, 1936).

CERASTIUM ARVENSE L. Disturbed soil, mile 19, *4877;* limestone outcrops, miles 12, *4857*, and 28½, *4933*.

Previously recorded in District of Mackenzie, only at Fort Smith (Cody, 1957), Great Bear Lake, and the Mackenzie River delta (Porsild, 1943). Known from Wood Buffalo Park (Raup, 1936).

CERASTIUM NUTANS Raf. Disturbed soil along road (east) to ford over Kakisa River, *4900*.

Second record for District of Mackenzie. Previously recorded from near the junction of the Mackenzie and Trout rivers (Cody, 1961).

LYCHNIS GILLETTII Boivin Limestone outcrops, miles 20, *4885*, 22, *5772*, and 28½, *4908* (tentative determinations by Gilbert Bocquet).

First record of this species for District of Mackenzie. No *Lychnis* is listed by either Porsild (1943) or Raup (1936, 1947) for southern Mackenzie, although these authors record several species of this genus from Great Bear Lake, Lake Athabaska, and Wood Buffalo Park.

RANUNCULACEAE

CALTHA NATANS Pall. Roadside pool, mile 10¼, *5577*.

First record for southwestern Mackenzie. Cody (1957) reports it for the north and southeast shores of Great Slave Lake. Not known elsewhere in District of Mackenzie.

RANUNCULUS CIRCINATUS Sibth. var. SUBRIGIDUS (W. Drew) L. Benson Pool along Kakisa River 2½ miles below highway bridge, *5709*.

First record from the Mackenzie River area above the delta. In southern Mackenzie the only other records of this plant are from Yellowknife and the Salt River (Cody, 1957).

RANUNCULUS FLAMMULA L. var. OVALIS (Bigel.) L. Benson Beach of Kakisa Lake east of outlet, *5635;* disturbed area along stream on road (west) to ford over Kakisa River, *5002*; shore of Kakisa River ¾ mile below highway bridge, *5716;* along stream, mile 46, *5114*.

Apparently the first record of this variety for District of Mackenzie. Our plants have leaves as broad as 5.7 mm, thus distinguishing them from the narrower leaved var. *filiformis* (Benson, 1948).

RANUNCULUS GMELINII DC var. LIMOSUS (Nutt.) Hara In shallow water and on mud around pool, disturbed soil, ferry landing (south), mile 82, *6018*. Young leaves and stems heavily pubescent; petals 5.2 mm long, 3.8 mm broad.

First record of this variety for District of Mackenzie. Reported from Wood Buffalo Park in Alberta by Benson (1948).

RANUNCULUS LAPPONICUS L. Shrub zone, marly lake, mile 50, *5396*.

Not previously known in southwestern Mackenzie outside the mountains, from which Raup (1947) cites but one specimen. Known from Great Slave Lake only at the eastern arm (Raup, 1936).

CRUCIFERAE

ARABIS DRUMMONDII Gray Grassland, mile 13-14, Mackenzie River—Fort Rae highway, *5029*.

Previously recorded, in the Mackenzie River lowlands, only at Fort Simpson (Cody, 1961). Not known elsewhere in southern Mackenzie except at Brintnell Lake.

BRASSICA CAMPESTRIS L. (*B. rapa* L.) Weedy area, Lady Evelyn Falls on Kakisa River, *6103*.

Second record for District of Mackenzie. Reported by Cody (1957) from Yellowknife.

CARDAMINE PENSYLVANICA Muhl. Islands in Kakisa River 4 miles below highway bridge, *5455*, *5686*.

First record for the Mackenzie River lowlands. Previously recorded, for District of Mackenzie, only from near Fort Smith and Hay River (Cody, 1957).

DRABA LANCEOLATA Royle Limestone outcrops, miles 20, *4884*, 26, *5533*, and 28½, *4915*.

Previously recorded, for southern Mackenzie, only in the mountains at Brintnell Lake (Raup, 1947) and from the eastern arm of Great Slave Lake (Raup, 1936).

ERYSIMUM INCONSPICUUM (Wats.) MacM. (*E. parviflorum* Nutt.) Slope above Kakisa River just below ford, *5206*.

This is apparently the first record of this species, with definite locality data, from southwestern Mackenzie. From the Great Slave Lake area, known only from Yellowknife River (Raup, 1936).

LEPIDIUM RAMOSISSIMUM Nels. Gravel of road fill, mile 51, *5380*.

New to the flora of District of Mackenzie.

DROSERACEAE

DROSERA ANGLICA Huds. Among sedges or in marl, at edge of marly lakes, miles 41½, *5410*, 42, *6141*, and 50, *5393*.

Previously unrecorded for southern Mackenzie. This species has been collected at Lake Athabaska (Raup, 1936) and at Great Bear Lake (Porsild, 1943).

SAXIFRAGACEAE

RIBES HUDSONIANUM Rich. forma *glabrum* f. nov. A. Ribes hudsonianum foliis, bracteis, squamis gemmarum, et inflorescentiis glabris differt. District of Mackenzie. N.W.T., Canada: disturbed soil in trembling aspen — white spruce forest above Kakisa River 1½ miles below Lady Evelyn Falls, *J. W. Thieret & R. J. Reich 4560* (type in herb. F).

RIBES TRISTE Pall. White spruce forest, mile 82, *6019*.

Previously unrecorded with exact locality data along the Mackenzie River above Wrigley (Raup, 1947). Known from the eastern arm of Great Slave Lake and from Fort Smith (Raup, 1936).

ROSACEAE

GEUM TRIFLORUM Pursh Limestone outcrops, miles 20, *4880*, 24, *5625*, and 28½, *4913*.

New to the flora of District of Mackenzie. Reported by Raup (1936) from Wood Buffalo Park. Our collections represent a range extension of 200 miles to the northwest.

POTENTILLA ARGUTA Pursh Disturbed soil over limestone, mile 25¼, *5974;* grassland 4 miles northeast of Fort Providence, *4113*.

New to the flora of District of Mackenzie. Our collections represent a range extension of about 250 miles northwest from Wood Buffalo Park where this species is "common in dry prairies and rock crevices" (Raup, 1936).

PRUNUS PENSYLVANICA L. Limestone outcrops, miles 12, *4852*, and 13, *5595;* limestone escarpment, mile 25, *4940;* slope above Kakisa River just below ford, *5199*.

Previously recorded, for District of Mackenzie, only along the Liard River between Nahanni Butte and Fort Simpson (Raup, 1947). This species is known also at Wood Buffalo Park (Raup, 1936).

PRUNUS VIRGINIANA L. Disturbed soil, mile 25, *4950;* limestone escarpment, mile 25, *4939;* limestone outcrops, miles 19¾, *5139*, and 20, *4886*.

New to the flora of District of Mackenzie. Previously unverified beyond the lower Athabaska River (Raup, 1947). Our collections thus represent a range extension of some 275 miles to the northwest.

LEGUMINOSAE

ASTRAGALUS DASYGLOTTIS Fisch. (*A. agrestis* Dougl.; *A. goniatus* Nutt.; *A. hypoglottis* sensu Raup). Grassland, Mackenzie River—Fort Rae highway, mile 13-14, *5030*, and 17, *4169*, *4201*.

First record of this species for the Mackenzie lowlands above Norman Wells. In southern Mackenzie known only from Alexandra Falls (Cody, 1957) and the junction of the Nyarling and Little Buffalo rivers (Raup, 1947).

ASTRAGALUS TENELLUS Pursh Disturbed soil, west channel of Hay River, south of Hay River town, *6129*.

First record of this species from Great Slave Lake. Previously known, in southwestern Mackenzie, only at Fort Simpson (Raup, 1947).

OXYTROPIS CAMPESTRIS (L.) DC. var. VARIANS (Rydb.) Barneby Crevices in limestone cliff, gorge of McNallie Creek, mile 23½, *5781*, *5960*.

First record of this variety for southern Mackenzie. Barneby (1952), in his distribution map of *O. campestris*, credits var. *varians* only to the northern third of District of Mackenzie. Specimens from Great Slave Lake and the Canol Road cited by Raup (1947) simply as *O. campestris* might possibly be referable to var. *varians*.

LINACEAE

LINUM LEWISII Pursh Disturbed soil, west channel of Hay River, south of Hay River town, *6128*.

Apparenty the first record, with exact locality data, from Great Slave Lake. Raup (1935, 1947) records this species from Fort Simpson and from Wood Buffalo Park.

CALLITRICHACEAE

CALLITRICHE HERMAPHRODITICA L. (*C. autumnalis* L.) Shallow water along Kakisa River just below Lady Evelyn Falls, *4017*, and 1 mile below highway bridge, *5714;* shore of Mackenzie River at ferry landing (south), mile 82, *4240;* in stream, mile 54, Mackenzie highway, *4352;* along McNallie Creek, mile 23½, *5780.*

Previously unreported from southern Mackenzie. Known in the Mackenzie delta region, in Wood Buffalo Park, and at Great Bear Lake (Raup, 1947).

VIOLACEAE

VIOLA NEPHROPHYLLA Greene Black spruce—larch forest along Kakisa Lake road ¾ mile from junction with Enterprise — Mackenzie River highway, *4709* (det. N. H. Russell).

New to the flora of District of Mackenzie. Raup (1935) reported this violet from Wood Buffalo Park (Moose Lake) from which station our collection represents a range extension of some 175 miles to the northwest.

ONAGRACEAE

EPILOBIUM ANGUSTIFOLIUM L. forma ALBIFLORUM (Dumort.) Haussk. Weed, vegetable garden, off mile 18, Mackenzie highway, *6137.*

First record of this form for southern Mackenzie. In our plant, the petals were white, the sepals whitish, and the full-grown capsules were green (not purple tinged as in nearby plants of forma *angustifolium*).

EPILOBIUM PALUSTRE L. var. OLIGANTHUM (Michx.) Fern. (*E. palustre* L. var. *monticola* sensu Raup). Disturbed soil, mile 76, *6029.*

First record from the Mackenzie lowlands above Norman Wells. Raup (1947) records this taxon from Wood Buffalo Park in Alberta. He cites but a single collection of var. *palustre* for southwestern Mackenzie, one from the Little Buffalo River.

UMBELLIFERAE

CICUTA DOUGLASH (DC.) Coult. & Rose (*C. occidentalis* Greene) Gravel bar, Kakisa River, above highway bridge, *6094;* beach of Kakisa Lake at outlet, *5643.*

New to the flora of District of Mackenzie. Reported by Raup (1947) from Wood Buffalo Park in Alberta.

PRIMULACEAE

DODECATHEON PULCHELLUM (Raf.) Merrill (*D. pauciflorum* [Dur.] Greene; *D. radicatum* Greene) Limestone outcrops, mile 20, *4882,* and 28½, *4922;* black spruce — larch forest, along Kakisa Lake road ¾ mile from junction with Enterprise — Mackenzie River highway, *4707;* disturbed soil, mile 20, *5776.*

Previously recorded, in District of Mackenzie, only from the junction of the Nyarling and Little Buffalo rivers and from Fort Resolution (Raup, 1947), some 100 miles eastward from our collections.

LYSIMACHIA THYRSIFLORA L. Island in Kakisa River 4 miles below highway bridge, *5690.*

First record from the Mackenzie lowlands. In the Northwest Territories known previously from Fort Rae (Raup, 1947) and Yellowknife (Cody, 1957).

PRIMULA INCANA Jones Grasslands 4 miles northeast of Fort Providence, *4117,* mile 17, Mackenzie River — Fort Rae highway, *4166;* disturbed marshy area, ferry landing (south), mile 82, *6000.*

First records from the Mackenzie River above Fort Norman (Cody, 1960). Not yet recorded, with exact locality data, from Great Slave Lake although known at Wood Buffalo Park (Raup, 1947).

GENTIANACEAE

GENTIANELLA CRINITA (Froel.) G. Don ssp. MACOUNII (Holm) Gillett Rocky slope, island in Mackenzie River 1 mile west of Fort Providence, *4132;* Kakisa River just below highway bridge, *6092;* beach of Kakisa Lake near outlet into Kakisa River, *6098.*

New to the flora of District of Mackenzie. The nearest localities for this taxon cited by Gillett (1958) are in central Alberta, some 525 miles to the south. The minutely papillose calyx-keels and the acute upper leaves distinguish this plant from *G. detonsa raupii,* the only fringed gentian recorded by Gillett for District of Mackenzie and which we collected (*5998*) on the shore of the Mackenzie River at the ferry landing (south), mile 82.

LOMATOGONIUM ROTATUM (L.) Fries Grassland, 4 miles northeast of Fort Providence, *4058, 4085, 4090.*

Along the Mackenzie River the only other record of this species with accurate locality data seems to be that of Cody (1960) from Norman Wells.

POLEMONIACEAE

COLLOMIA LINEARIS Nutt. Slope above Mackenzie River at Fort Providence, *4224;* disturbed soil, mile *66*, *5233;* disturbed soil, mile 26, *5782*.

Second record with exact locality data for District of Mackenzie. Collected by Raup (1947) at Fort Simpson. Not yet recorded from Great Slave Lake but certainly to be expected there.

LABIATAE

STACHYS PALUSTRIS L. var. NIPIGONENSIS Jennings Grassland 4 miles northeast of Fort Providence, *4042*, *4063*, *4101;* along Kakisa River 2½ miles below highway bridge, *5744*.

First record of this variety for District of Mackenzie. We collected also the var. *pilosa* (along shore of Hay River, mile 49, Mackenzie Highway, *4364*), which is distinguished from var. *nipigonensis* by its oblong to oval (rather than lanceolate) leaves.

SCROPHULARIACEAE

EUPHRASIA aff. SUBARCTICA Raup Rocky slope, island in Mackenzie River 1 mile west of Fort Providence, *4130*.

First record of a species of *Euphrasia* for southwestern Mackenzie. *Euphrasia subarctica* is reported by Raup (1936) from Lake Athabaska and the eastern arm of Great Slave Lake. Of our collection of *Euphrasia,* the monographers of North American *Euphrasia,* P. F. Yeo and P. D. Sell, have written to me: "Specimen *4130* . . . has the general characters of *E. subarctica* Raup, but all the plants in the series seen lack long glandular hairs, which usually densely cover the leaves in this species, and if they do not, are present on at least some plants in all the samples we have seen. We are therefore not able to accept these specimens as being definitely *E. subarctica,* but they might be recorded as showing affinity with the species."

VERONICA SCUTELLATA L. forma VILLOSA (Schum.) Penn. Beach of Kakisa Lake just east of outlet, *5646;* along Kakisa River just below Lady Evelyn Falls, *5460;* in mud along creeks, miles 23½, *5773*, and 45, *5725;* disturbed soil, miles 60, *6068*, and 76, *6028*.

First record of this form for District of Mackenzie.

LENTIBULARIACEAE

PINGUICULA VILLOSA L. Black spruce — larch forest along Kakisa Lake road ¾ mile from junction with Enterprise — Mackenzie River highway, *4701*.

First record for southwestern Mackenzie outside the mountains, whence Raup (1947) records a single specimen from Brintnell Lake. Reported by Raup (1936) from the eastern arm of Great Slave Lake and by Porsild (1943) from Great Bear Lake.

PLANTAGINACEAE

PLANTAGO SEPTATA Morris Limestone outcrops, miles 21½, *5606*, and 28½, *4907*.

First records for the Great Slave Lake region. On the upper Mackenzie River reported from Fort Simpson (Raup, 1947). Known also from the Mackenzie delta, Great Bear Lake, and Fort Norman (Porsild, 1943; Raup, 1947) in District of Mackenzie.

RUBIACEAE

GALIUM LABRADORICUM Wieg. Among sedges, marly lake, mile 43, *4958;* edge of stream, along road (west) to ford over Kakisa River, *5003;* disturbed soil along *stream,* mile 19½, *5677;* disturbed peaty soil, mile 6, *5954*, and 42, *6143*.

New to the flora of District of Mackenzie. Recorded from just south of the Mackenzie-Alberta border near Fort Smith by Cody (1957).

CAPRIFOLIACEAE

LONICERA DIOICA L. var. GLAUCESCENS (Rydb.) Butters Jack pine forest, mile 27¾, *4938;* jack pine forest, mile 56, *5010a;* jack pine forest, mile 71, *5070;* limestone outcrop, mile 24, *5130;* sandy soil along road (west) to ford over Kakisa River, *5207;* among jack pines, mile 13, *5596*.

Previously recorded with exact locality data from only Fort Smith and Fort Simpson (Raup, 1947) in District of Mackenzie.

LOBELIACEAE

LOBELIA KALMII L. In marl or among sedges, marly area, mile 20, *5764;* in marl among sedges, marly lake, mile 44½, *6110*.

Known from only two other localities in District of Mackenzie, at the north arm of Great Slave Lake and "between southern extremities of Franklin Mts." (Raup, 1947).

COMPOSITAE

ANTENNARIA PULCHERRIMA (Hook.) Greene Disturbed soil, mile 20, *5767*.

Our collection is the first record of this species from the Great Slave Lake area. Reported by Cody (1961) from Fort Simpson. Raup's (1947) only record is from Lone Mountain. Elsewhere in District of Mackenzie known only from Great Bear Lake (Porsild, 1943).

ANTENNARIA SUBVISCOSA Fern. Grassland, mile 17, Mackenzie River — Fort Rae highway, *4194a*.

Second record for District of Mackenzie. Reported by Raup (1947) from Brintnell Lake.

ARTEMISIA CAMPESTRIS L. ssp. BOREALIS (Pall.) Hall & Clem. Limestone outcrops, miles 13½, *5569*, 21½, *5609*, and 24, *5627*.

Previously unrecorded for southwestern Mackenzie. Raup (1936) cites specimens from the eastern arm of Great Slave Lake.

ARTEMISIA LUDOVICIANA Nutt. var. GNAPHALODES Nutt.) T. & G. Disturbed soil, mile 9½, *6117*.

Our collection represents the second record of this species from District of Mackenzie and a range extension of some 150 miles northwest from the other Mackenzie collection, one from Fort Smith (Cody, 1957).

ASTER ALPINUS L. var. VIERHAPPERI (Onno) Cronq. Limestone outcrops, miles 13, *5589*, 15, *5757*, 21½, *5605*, 22¾, *5158*, 23½, *5962*, 24, *5628*, 25 1/10, *6149*, and 26, *4334*, *5531*.

Previously recorded with exact locality data, for District of Mackenzie, only at Nahanni and Lone Mountains (Raup, 1947) and at Great Bear Lake and Bear River (Porsild, 1943).

ASTER HESPERIUS Gray var. LAETEVIRENS (Greene) Cronq. Limestone bluffs along Hay River at Alexandra Falls, *4375* (det. Arthur Cronquist), *6159;* along Hay River near mile 49, Mackenzie Highway, *6168*, *6169*.

New to the flora of District of Mackenzie. The previously known Canadian range of this species included only Saskatchewan and Alberta, according to Cronquist (1955).

ASTER PANSUS (Blake) Cronq. Grassland, 4 miles northeast of Fort Providence, *4087*, *4104* (det. Arthur Cronquist).

New to the flora of District of Mackenzie. According to Cronquist (1955), the previously known northern limit for this species was "e. Wash and s. B.C. to Mont."

CREPIS ELEGANS Hook. Along road to Louise Falls from Mackenzie highway, about 35 miles south of Hay River, *6153*.

Previously unrecorded in the Great Slave Lake region. The nearest known station in southwestern Mackenzie is at Fort Simpson, some 190 miles to the northwest (Raup, 1947).

CREPIS TECTORUM L. Disturbed soil, mile 23½, *5959;* gravel pit, mile 30, *6116;* disturbed soil, mile 30, Mackenzie highway, *5140*.

Our collections are the second record of this introduced weedy species in District of Mackenzie. Cody (1957) reported it from Fort Smith.

ERIGERON COMPOSITUS Pursh var. GLABRATUS Macoun Crevices atop limestone bluff, gorge of McNallie Creek, mile 23½, *5961*.

First record of this variety for District of Mackenzie. Cronquist (1947) does not record it for the Northwest Territories.

SENECIO EREMOPHILUS Rich. Disturbed soil, along road (east) to ford over Kakisa River, *5327* (determined by T. M. Barkley).

Second record for District of Mackenzie. Previously recorded from the Salt River, about 175 miles southeast of our locality (Cody, 1957).

SENECIO PLATTENSIS Nutt. Grassland, mile 13-14, Mackenzie River — Fort Rae highway, *5031* (det. T. M. Barkley).

New to the flora of District of Mackenzie.

SENECIO TRIDENTICULATUS Rydb. Limestone outcrops, miles 12, *4844*, 19, *4875*, and 28½, *4912*, and on summit of escarpment above south shore of Kakisa Lake, *4674;* jack pine forest, mile 56, *5009* (determinations by T. M. Barkley).

New to the flora of District of Mackenzie.

SONCHUS ARVENSIS L. var. GLABRESCENS Guenth., Grab., & Wimm. (*S. uliginosus* Bieb.) Disturbed soil, mile 54, Mackenzie highway, *4344*, *6172*.

New to the flora of District of Mackenzie. Moss (1959) states that this plant has become very common in Alberta during the past 20 years.

TARAXACUM LACERUM Greene Disturbed soil along road (east) to ford over Kakisa

River, *4558;* limestone crevices, gorge of McNallie Creek, mile 23½, *5133*.

Previously reported, in southwestern Mackenzie, only in the mountains and at the mouth of the North Nahanni River (Raup, 1947). Our collections extend the range some 250 miles to the southeast. Not recorded from the Great Slave Lake region.

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VARIATION AND RELATIONSHIPS IN NORTH AMERICAN MARTEN

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Introduction

The true martens (subgenus *Martes*) are made up of five holarctic species, only one of which (*Martes americana*) occurs in the new world. This species is currently divided into two 'subspecies groups,' each of which is made up of seven subspecies (Wright, 1953; Hall and Kelson, 1959).

In an earlier paper (Hagmeier, 1958), I attempted to show that while geographic variation in one of the subspecies groups (the *americana* group) occurred, it was moderate, clinal, and discordant. On these grounds, I concluded that subspecies in the group could be delimited by subjective means only.

The purpose of the work reported here is threefold: (1) to further elucidate the distinctions between the subspecies groups, (2) to describe variation within the *caurina* group, and (3) to evaluate relationships between North American martens and those of the old world.

The work reported was in part a thesis directed by Dr. I. McT. Cowan, and presented to the University of British Columbia; it has since been considerably modified. Acknowledgment is made of the assistance of Dr. Cowan, other members of the University staff, and the curators of the museums who provided specimens for examination. Funds for support of the work were provided by the British Columbia Sugar Company, and the National Research Council of Canada.

Materials

A total of 2866 specimens was examined during the course of this study, and of these, measurements were made on 1452 (Appendix 1). A listing of specimens by locality and collection, while useful, was considered unwieldy for a paper of this length. The identity of specimens, however, likely would be reasonably duplicated by obtaining the holdings of the collections studied up to 1954 (Appendix 2).

Locality samples were subdivided by sex and age. Sex was determined from the collector's information, or where this was inadequate, by fitting to bar graphs made up from measurements of specimens of known sex from the same locality. Samples were separated into two age classes (mature and immature) on the basis of degree of fusion of the nasomaxillary suture (Rhoads, 1902).

A series of about two dozen cranial dimensions was measured by vernier calipers and from these a dozen were selected on the basis of their low local variability, low variability between age classes, and relatively high geographic variability (Appendix 3).

Analysis showed that measurements made on males averaged about 1.10 times the same measurement made on females from the same locality. In the account following, greater emphasis is given to measurements of males;

approximate equivalents for measurements of females may be obtained by multiplying by 1/1.10 = .090.

Methods of analysis of geographic variation used are outlined in appropriate places in the text.

TAXONOMIC SYNOPSIS

North American martens were first described by Buffon and d'Aubenton (1758 and 1765). Since that time they have been variously described as belonging to the Eurasian species *M. martes*, *M. foina* and *M. zibellina*, or separated from them as a varying number of distinctive new world species. Kerr in 1792 first used the epithet *americana* (as the last term of a trinomial), and Thomas (1879) and Allen (1895) both attribute the name to him. Turton in 1802 and 1806 used the term in binomial form and he is generally considered the authority for the name. Although many workers of the nineteenth century dealt with martens in varying degrees of detail, it was not until 1890, when Merriam described *M. caurina* from the west coast, that work of taxonomic significance was initiated. With him was begun an era of splitting, such that by 1924 Miller was able to list six species and six additional subspecies of North American marten.

Grinnell and Dixon in 1926 apparently were the first to suspect that two basic types of North American marten existed: *M. caurina* from the mountains of the west coast, and *M. americana* from the rest of the species range. It remained for Allen in 1942 to complete the classification by this scheme. Hall in 1936 first suggested that the two species might themselves intergrade (see also Hall, 1946; Dalquest, 1948; and Durrant, 1952). Wright (1950 and 1953) provided full evidence for this by showing that the two underwent intergradation in northern Idaho and Montana. He accordingly reduced the two species to subspecies "groups" or "types." Wright's scheme has been accepted in essentials by Hall and Kelson (1959), except that they do not group the subspecies.

An outline of the currently accepted subspecies of *Martes americana* follows. In it descriptions are based on shade of fur as seen on the dorsal surface, and on size. Concordance in variation of these is assumed, although I have no evidence that such is the case.

M. a. americana (Kerr, 1792; or Turton, 1802).

A small, pale marten occurring in that part of the species range east of Manitoba and the Dakotas, and south of Lake Mistassini in Quebec.

M. a. brumalis (Bangs, 1898).

A large, dark marten, occurring in the Quebec-Labrador peninsula north of Lake Mistassini.

M. a. atrata (Bangs, 1897).

Identical, so far as I can tell, to *M. a. brumalis*. Bangs described this race as being small, but examination of his and other material indicates that he mistook female individuals for males. Restricted to insular Newfoundland, and possibly Anticosti Island (Newsom, 1937).

M. a. abieticola (Preble, 1902).

A large marten, as large as *brumalis* and *atrata*, but usually of paler color. It occurs from Manitoba and Keewatin west to central Alberta and probably into parts of Mackenzie.

M. a. actuosa (Osgood, 1900).

Included here are *M. a huro* Gray (1865 and 1869) from Fort Franklin, and *M. a. boria* (Elliot, 1905) from the lower Mackenzie River area. It is large and pale in color, highly variable, but probably indistinguishable from *M. a. abieticola*. It occurs from Alaska (exclusive of the Kenai Peninsula and adjacent regions) east into the Yukon, Mackenzie, and Alberta, and south into British Columbia (except for the Coast Range), to the Peace River and Driftwood River regions.

M. a. kenaiensis (Elliot, 1903).

Although originally described as smaller than *M. a. actuosa* (Elliot, 1903; Osgood, 1901; Allen, 1902 and 1903), it is actually as large, or nearly so. It is however, reported to be darker in color. (I was able to examine skulls only.) It is restricted to the Kenai Peninsula and adjacent regions.

M. a. abietinoides Gray, 1865.

A small, dark marten, found in British Columbia east of the Coast Range and into the foothill region of Alberta, and south of the range of *M. a. actuosa*, extending into northern Idaho and the Whitefish range of Montana.

M. a. caurina (Merriam, 1890).

A small marten, of considerable variability in color, but generally paler than *abietinoides*, and darker than *actuosa*. It occurs in the Coast and Cascade ranges of Oregon and Washington, in the Coast Mountains of British Columbia, and north to about Juneau, Alaska, or perhaps farther.

M. a. humboldtensis Grinnel and Dixon, 1926.

A very small marten, smaller perhaps than any other subspecies. Coloration as in *M. a. caurina*. Restricted to the Coast Range of California, and perhaps southern Oregon.

M. a. vancouverensis Grinnell and Dixon, 1926.

Inseparable, so far as I can tell, from *M. a. caurina*. Restricted to Vancouver Island, and perhaps some of the adjacent Gulf islands.

M. a. nesophila (Osgood, 1901).

A large, pale marten, distinctive in many of its features. It occurs on the Queen Charlotte Islands, on at least some of the Alexander Archipelago, and possibly on parts of the adjacent mainland.

M. a. vulpina (Rafinesque, 1819 a and b).

Described by Rafinesque as from the "regions . . . watered by the Missouri," and by Elliot (1901) as from the "Upper Missouri," this subspecies was

considered a synonym of *M. a. abietinoides* by Gray (1865) and of *M. a. americana* by Elliot (1901) and Rhoads (1902). Hall and Kelson (1959) have given the name new stature by applying it to those marten in the Northern and Middle Rocky Mountains south of the range of *M. a. abietinoides*. Martens of this region have in the past been referred to either *M. a. caurina* or *M. a. origenes*. So far as I am able to tell, however, they differ in no significant respect in either size or color from *M. a. caurina*.

M. a. origenes (Rhoads, 1902).

Although originally described as paler, it falls within the range of color shown by *M. a. caurina*, and in all respects appears the same. It is now (according to Hall and Kelson, 1959) restricted to Colorado, New Mexico, Utah, and southern Wyoming.

M. a. sierrae Grinnell and Storer, 1916.

A small, pale marten, inseparable from *M. a caurina* excepting by its reportedly paler coloration. Occurs in the Sierra Nevadas of California, extreme western Nevada, and perhaps southern Oregon.

SUBSPECIES GROUPS

All subspecies of North American martens fall into two groups: those with relatively low, broad skulls, short broad auditory bullae, and large upper molars, and those with relatively high, narrow skulls, long narrow bullae, and small upper molars (Appendix 4). These two groups correspond to the two "species" *Martes caurina* and *M. americana* of Grinnell and Dixon (1926) and Allen (1942), and the subspecies groups *caurina* and *americana* of Wright (1953). The *americana* group is made up of the following subspecies: *M. a. americana, brumalis, atrata, abieticola, actuosa, kenaiensis*, and *abietinoides;* the *caurina* group of *M. a. caurina, humboldtensis, vancouverensis, nesophila, vulpina, origenes*, and *sierrae*. Wright has shown that the subspecies groups intergrade in western Montana and northern Idaho. Further evidence of intergradation has been found in Manning Park in southwestern British Columbia (Figure 1), but nowhere else to my knowledge.

A variety of morphologic distinctions may be used to separate the subspecies groups (Wright, 1953. See also Appendix 4). Of these I selected the ratio of canine width/bulla length (see Appendix 3 for terms used). This ratio is usually less than .94 in the *americana* group, and more in the *caurina* group. The mean values of this ratio, as they vary geographically, are plotted in Figure 2.

From Figures 1 and 2, I conclude that the ranges of the two groups meet along the eastern side of the Coast Range, and in Manning Park, British Columbia; and that a zone of intergradation separates the two in Kootenai, Shoshone, Benewah, Latah and Clearwater counties, Idaho; and Sanders, Lake, Flathead, Lewis and Clark, Powell, Granite, Missoula and Mineral counties, Montana. Analyses of geographic variation in other significant morphologic characteristics give approximately similar results, and suggest concordance of variation.

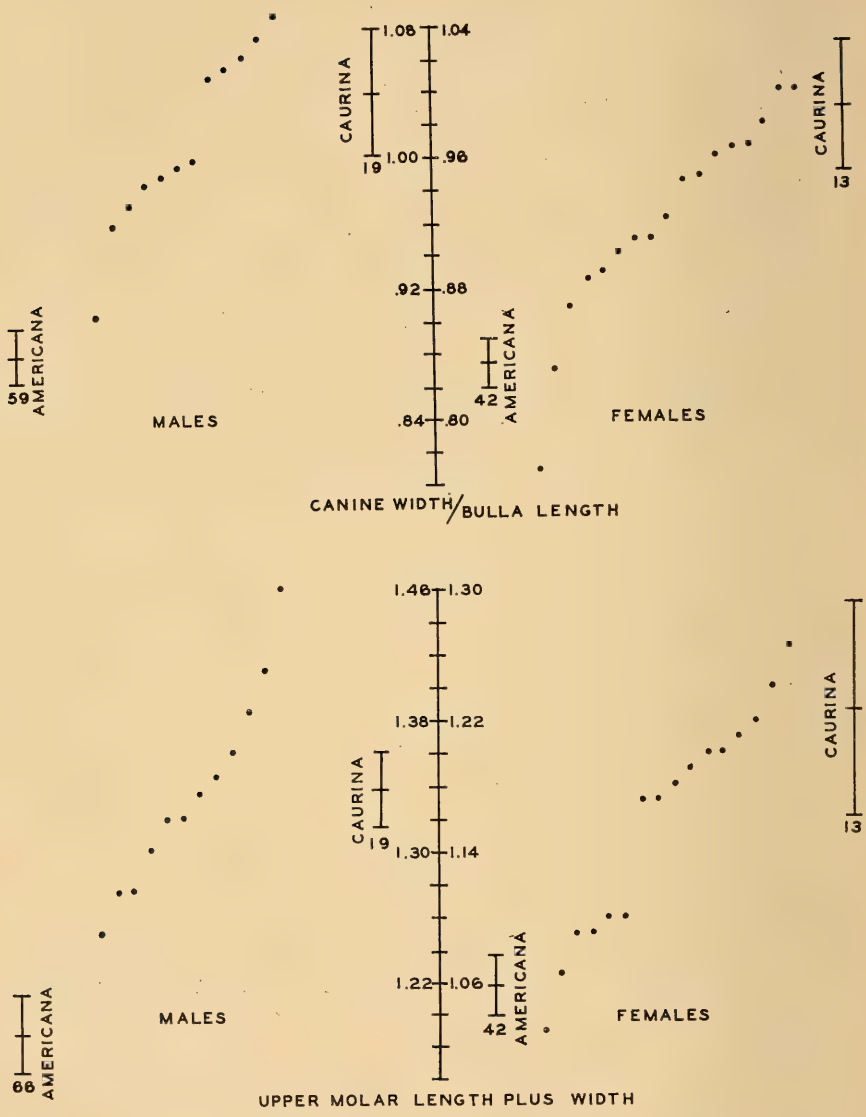


FIGURE 1. Evidence of intergradation between the *caurina* and *americana* groups in Manning Park, southwestern British Columbia. Shown also are the mean plus and minus two standard errors of the mean of samples of the two groups from adjacent areas.

FIGURE 2. Ratio of canine width/bulla length of male marten in western North America. In general, samples of the *caurina* group show a ratio larger than .94, of the *americana* group less. Samples from the Yukon and Northwest Territories showing relatively large values of the ratio are represented by single specimens, and are referable in other features to the *americana* group.

The width of the zone of intergradation in British Columbia is known only in Manning Park, where it occurs within the limits of the park itself. Nor is the northern limit of the *caurina* group known with any assurance. Two specimens from Taku in the Alaskan panhandle are referable to the *caurina group*, and one from Yakutat is intermediate between *caurina* and *americana*.

THE *caurina* SUBSPECIES GROUP

The *caurina* group is made up of seven subspecies, whose names, ranges and characteristics have been summarized above. Cranial measurements of these are given in Appendix 5. Analysis of variance of these gave F values significant at the .05 level or higher. Further comparison of subsample means of Dice-Leraas (1936) diagrams showed that all subspecies are separable from others in at least several characters, and in at least one sex.

Examination of the literature indicates that most of the subspecies were named chiefly on the basis of size and color of pelage. Condylobasal length provides a good measure of size in martens, and an analysis of its geographic variation was carried out. Pelage color was found so difficult to use quantitatively that its results have not been used here.

Samples were grouped geographically as follows: Queen Charlotte Islands, Alexander Archipelago, Alaska panhandle, Vancouver Island, northern British Columbia, southern British Columbia, Washington coast, Oregon coast, Washington Cascades, Oregon Cascades, California coast, California Sierra Nevada, Northern Rocky Mountains, Middle Rocky Mountains, Wasatch and Uinta mountains, and Southern Rocky Mountains. In many cases these samples are isolated geographically from each other. Sample means for males then were compared by *t* tests (Figure 3). I concluded from these, that while almost every sample could be distinguished from some other, there are essentially three sizes of marten: those from the Queen Charlotte Islands, Alexander Archipelago and Alaska panhandle, with a condylobasal length of about 8.18 cm or larger (*M. a. nesophila*); those from the California coast, about 7.66 cm (*M. a humboldtensis*); and those remaining, ranging from about 7.83 to about 8.03 cm (*M. a. caurina, vulpina, origenes, sierrae,* and *vancouverensis*). Variation between these is relatively slight, (in the order of 8.3%), somewhat less than that found in the *americana* group (12.5%). Geographic variation in size in the *caurina* group is shown in Figure 4.

No attempt was made to test degree of concordance of geographic variation, within the *caurina* group.

RELATIONSHIPS BETWEEN AMERICAN AND OLD WORLD MARTEN

The genus *Martes* is made up of three or four Recent subgenera. It is however only within the subgenus *Martes* (Pinel, 1792; Gray, 1865), that relationships have been sought.

The subgenus *Martes* contains five species: *Martes americana, M. foina, M. martes, M. zibellina* and *M. melampus*. All but the first are Eurasian in distribution (Figure 5).

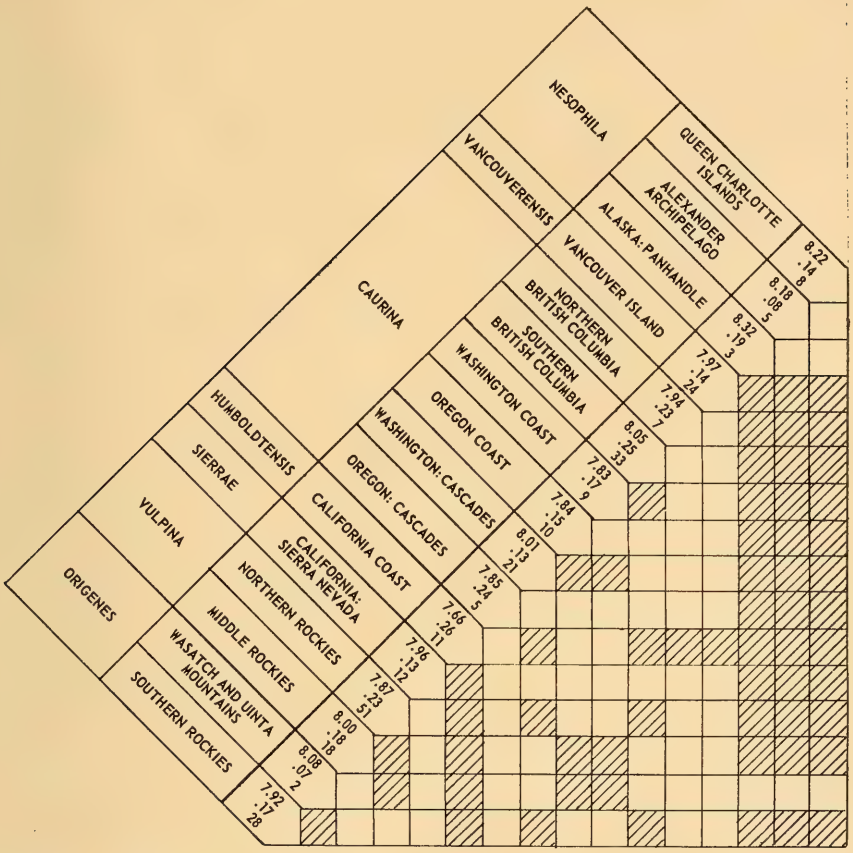


FIGURE 3. Results of comparison of sample means of condylobasal length of male marten by *t* tests. Comparisons giving a P value less than .05 are shaded, and to be considered statistically separable. Given also, are mean, standard deviation (in centimeters), and size of sample (n).

I have been able to examine representatives of all these species (as well as those of the remaining subgenera), and conclude that, surprisingly, there is greater similarity between crania of *M. martes*, *M. zibellina*, *M. melampus* and the *caurina* section of *M. americana* than there is between the crania of the *caurina* and *americana* groups. This conclusion must be considered provisional and must await much more detailed analysis before it is acted upon.

Brongersma (1941) devised a series of ratios to separate fossil representatives of several of the Eurasian species. I have computed his ratios (with the addition of another of my own devising) for the material I have examined, pooled them with his results where they were suitable, and drawn them up as

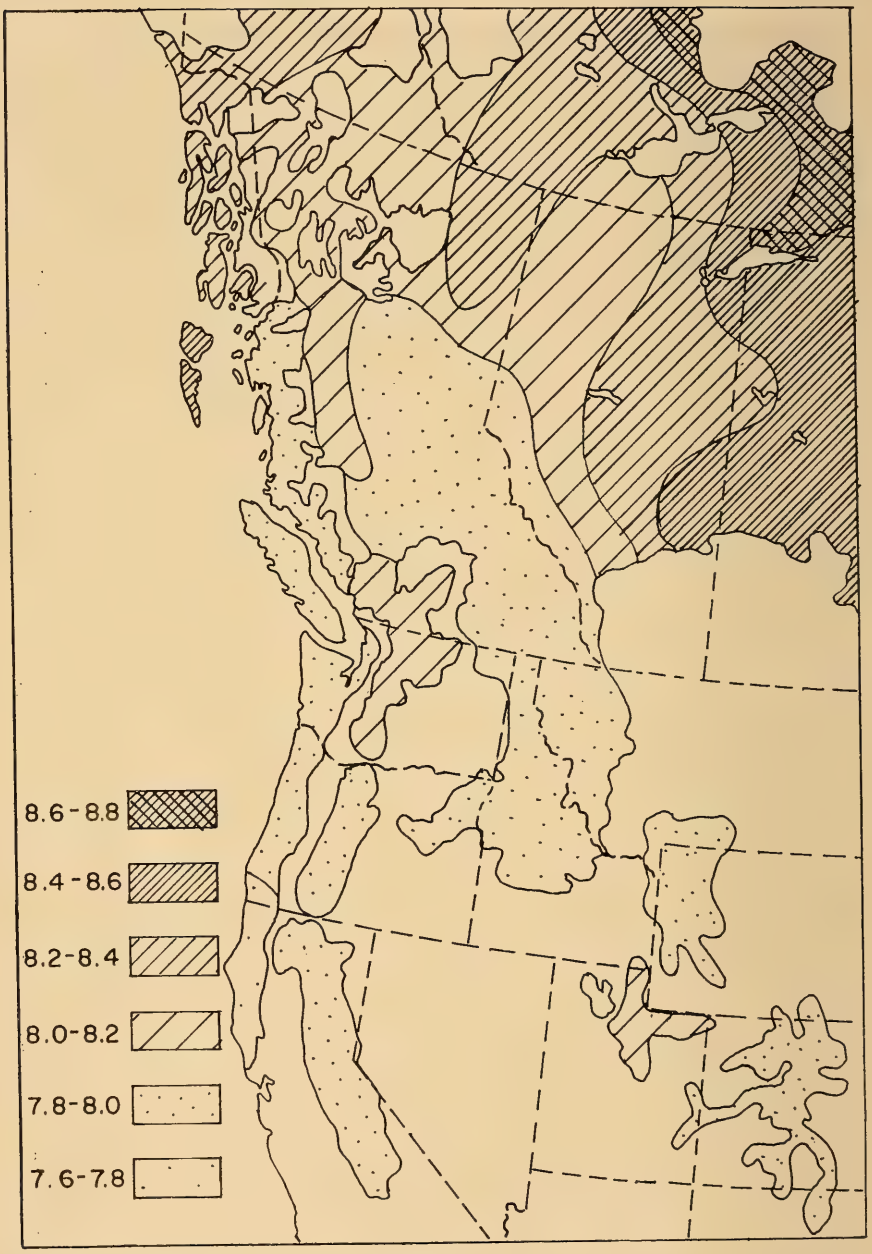


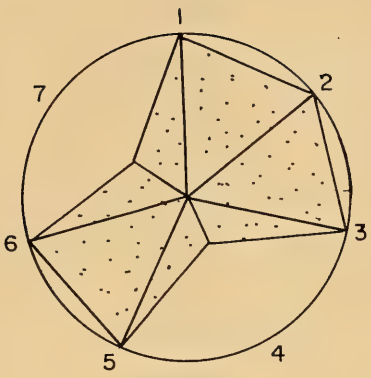
FIGURE 4. Geographic variation in condylobasal length of male marten in western North America; measurements are in centimeters.

FIGURE 5. Distribution of marten of the subgenus *Martes* in Eurasia.

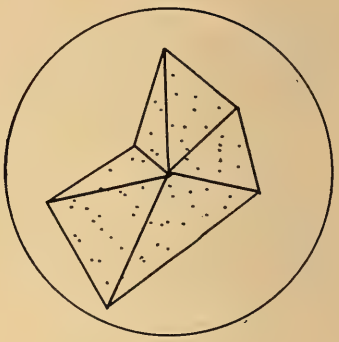
pie diagrams (Figure 6). They summarize to some extent, the rather subjective evidence that has led to the conclusion outlined above.

The recognition of three species of European marten (*M. martes*, *M. foina*, and *M. zibellina*) apparently is as old as Aristotle, Pliny, Agricola and Albertus Magnus (Alston, 1879; de Blainville, 1841; Kerr, 1792; Shitkov, 1940). The distinctions between them, therefore, must be reasonably marked to have been recognized so early; these species have furthermore been maintaind by Old World systematists to the present. Streuli (1932) and Rhode and Didier (1944) failed to find any intermediates between *M. foina* and *M. martes* out of a large series of specimens examined. Ellerman and Morrison-Scott (1951) concluded, however, that specimens of the two species sometimes are difficult to distinguish. *M. martes* and *M. zibellina* were reported to intergrade in the Tienschan Mountains (Severtzoff, after Schmidt, 1943), and Ponomarov (1946, paper not seen) is reported to have obtained hybrids from crosses of the two species.

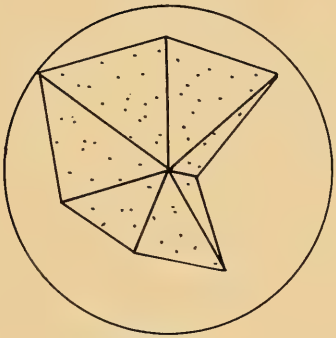
The distributions of *M. martes* and *M. foina* are sympatric in part, suggesting reasonable likelihood of specific distinction. On the other hand, *M. martes*, *M. zibellina* and *M. melampus* replace each other geographically (Figure 5). Further Schmidt (1941) and Marshall (1942) both have pointed out that



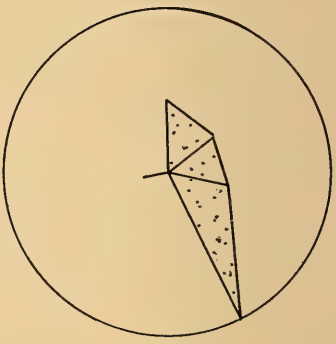
MARTES



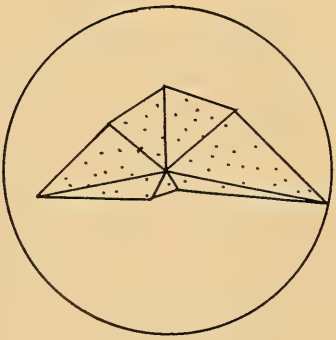
ZIBELLINA



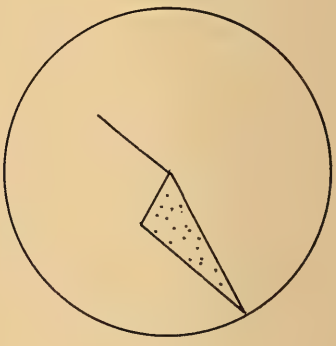
MELAMPUS



AMERICANA



CAURINA



FOINA

M. foina occupies a distinctive ecologic niche from that occupied by *M. martes*, *M. zibellina* and *M. melampus*.

I suggest, then, that on grounds of similarity of cranial characteristics, allopatricity of ranges, and similarity of general ecologic attributes, there is reason to suspect that *M. americana*, *M. martes*, *M. zibellina* and possibly *M. melampus* may one day be shown to be members of a single circumboreal species. This hypothesis is furthered by Bobrinskoy, Kuznetzov, and Kuzyakin's (1944), and Rausch's (1953) conclusion that about 45% of terrestrial Alaskan mammals are members of holarctic species. For other (in some cases similar) viewpoints, reference may be made to Gray (1865), Baird (1857), Allen (1869), Coues (1877), Merriam (1890), Rhoads (1902) and Ognev (1931).

A provisional artificial key to the crania of the species of the genus *Martes* is given in Appendix 6. Other keys to a restricted number of species are given by Miller (1912), Ognev (1931), Bobrinskoy, Kuznetzov and Kuzyakin (1944) and others.

CONCLUSIONS

(1) When subspecies of the *caurina* group of *M. americana* are compared in terms of size (using condylobasal length), three classes may be identified: (a) small, *M. a. humboldtensis*, and (b) large, *M. a. nesophila*, each of which is separate from (c) the intermediate group which includes all of the remaining subspecies. The degree of variation between them is slight, less than that between subspecies of the *americana* group.

(2) The distinctions separating the *caurina* group from the *americana* group are of a higher order than those separating the subspecies within either of the groups.

(3) The distinctions between the two subspecies groups appear greater than the distinctions between the *caurina* group and the Eurasian species *M. martes*, *M. zibellina*, and possibly *M. melampus*. This suggests that all four species may be conspecific.

These points, together with the finding that geographic variation in the *americana* group of *M. americana* is discordant, cause me to conclude that current classification of North American marten does not describe the apparent facts. Under these circumstances, I believe that little is to be gained and much to be lost by continuing to divide the species into subspecies.

FIGURE 6. Pie diagrams depicting ratios of cranial characteristics of marten of the subgenus *Martes*. The length of each arm represents percentage of the range between largest and smallest values obtained. The characteristics ratios together with their upper and lower values (for purposes of computation) are:

1. Width of inner lobe of P^4/Width of trenchant part of P^4; .57-.84.
2. Width of inner lobe of P^4/Length of P^4; .22-.30.
3. Width of M^1/Length of P^4; .92-1.00.
4. Labial length of M^1/Lingual length of M^1; .70-.83.
5. Lingual length of M^1/Width of M^1; .62-.74.
6. Width of P^4/Length of P^4; .60-68.
7. Canine width/Bulla length; .87-1.18.

APPENDIXES

Appendix 1. Taxonomic distribution of the specimens examined and measured

		Examined	Measured
Martes flavigula		32	2
M. foina		81	19
M. martes		12	7
M. zibellina		77	20
M. melampus		8	3
M. americana	*americana*	413	202
	brumalis	128	107
	atrata	11	11
	abieticola	102	18
	actuosa	551	292
	kenaiensis	49	30
	abietinoides	587	363
	caurina	308	136
	humboldtensis	20	20
	vancouverensis	51	35
	nesophila	61	33
	vulpina	307	114
	origenes	30	23
	sierrae	38	17
Total		2866	1452

Appendix 2. Collections examined

University of British Columbia, British Columbia Provincial Museum, National Museum of Canada, Royal Ontario Museum of Zoology, University of Michigan, Carnegie Museum, Museum of Vertebrate Zoology (Berkeley), American Museum of Natural History, United States National Museum, United States Biological Survey, University of Utah, Museum of Comparative Zoology (Cambridge), Peabody Museum (New Haven). Besides these, I have examined specimens in the possession of: Messrs. R. Y. Edwards, R. Webb, J. Bryant, K. Racey, and Drs. P. L. Wright, L. E. Yeager, and W. Cottle. Mr. D. Flook and Dr. C. Lensink donated specimens, and Mr. E. McEwen sent measurements of specimens in his collection.

Appendix 3. Measurements used

1. Condylobasal length: distance from the most anterior point of the premaxillae to the midpoint of a line connecting the most posterior surfaces of the occipital condyles.
2. Canine width: width separating the outer sides of upper canines, measured at alveoli.
3. Bulla length: used in two ways: (a) in Figure 6, and Appendix 6, means greatest length of bulla, measured from the external carotid foramen to the hind surface of the jugular process; (b) elsewhere it is measured from the external carotid foramen to the midpoint of the suture located on the surface of the jugular process.

4. Width of M^1: greatest labial-lingual width of upper molar.
5. Lingual length of M^1: greatest anteroposterior length of the inner lobe of the upper molar.
6. Mastoid width: the greatest width separating the outer surfaces of the mastoid processes.
7. Height of skull: the greatest dorsoventral height of the cranium, taken at and including the deepest part of the bullae, but excluding the sagittal crest if present.
8. Length of P^4: greatest length of the trenchant part of the last upper premolar.
9. Width of inner lobe of P^4: width of inner lobe of last upper premolar.
10. Width of trenchant part of P^4: width of main part of last upper premolar, exclusive of small inner lobe.
11. Labial length of M^1: greatest anteroposterior length of the outer lobe of the upper molar.
12. Width of P^4: greatest width of the last upper premolar, measured so as to include the small inner lobe.

Appendix 4. Distinctions between the crania of the *americana* and *caurina* groups of *M. a. americana*

americana group:
Width of inner lobe of P^4/Length of P^4 less than .258;
Width of M^1/Length of P^4 less than .975;
Labial length of M^1/Lingual length of M^1 more than .770;
Width of P^4/Length of P^4 less than .640;
Canine width/Bulla length less than .940.

caurina group:
Width of inner lobe of P^4/Length of P^4 more than .258;
Width of M^1/Length of P^4 more than .975;
Labial length of M^1/Lingual length of M^1 less than .770;
Width of P^4/Length of P^4 more than .640;
Canine width/Bulla length more than .940.

Appendix 5. See table on page 136.

Appendix 6. Key to the named species of Recent marten. This has been prepared from a large series of cranial measurements, but has not yet been tested; it must therefore, be considered provisional.

1a. Labial length of M^1/lingual length of M^1 more than .89, lingual length of M^1/width of M^1 less than .56 ..... *M. flavigula* (including *M. guatkinsi*)
1b. Not as above 2
2a. Width of inner lobe of P^4/width of trenchant part of P^4 less than .65; width of M^1/length of P^4 less than .94 3
2b. Not as above 4
3a. Width of inner lobe of P^4/length of P^4 more than .25; condylobasal length more than 9.25 cm ..... *M. pennanti*

Appendix 5. Cranial measurements of the subspecies of the *Caurina* group; given are mean, standard deviation and sample size of the first eight measurements listed in Appendix 3, in centimeters.

	caurina			*vulpina*			*origenes*			*humboldtensis*			*sierrae*			*vancouverensis*			*nesophila*		
										Males											
1.	7.89	.22	100	7.90	.22	69	7.92	.17	28	7.66	.26	11	7.96	.13	12	7.97	.14	24	8.19	.11	14
2.	1.52	.07	106	1.53	.07	66	1.53	.05	28	1.45	.05	4	1.50	.05	12	1.57	.05	24	1.71	.05	16
3.	1.50	.08	104	1.51	.05	66	1.49	.04	28	1.48	.03	4	1.47	.03	12	1.55	.04	24	1.51	.04	16
4.	.82	.04	107	.85	.05	66	.82	.04	28	.82	.08	4	.86	.03	12	.84	.03	24	.85	.09	16
5.	.52	.03	107	.56	.04	72	.53	.04	28	.51	.06	4	.56	.02	12	.48	.02	24	.53	.04	16
6.	3.64	.12	78	3.72	.09	50	3.71	.13	18	3.50	.08	8	3.64	.07	8	3.64	.07	24	3.79	.10	10
7.	2.89	.10	78	2.97	.08	50	2.95	.08	18	2.86	.05	8	2.89	.09	8	3.04	.07	24	3.10	.05	10
8.	.83	.04	107	.84	.04	65	.83	.03	28	.82	.06	4	.87	.02	12	.83	.02	24	.89	.11	16
										Females											
1.	7.20	.22	29	7.17	.17	41	7.20	.21	19	6.85	.11	8	7.08	.11	4	7.32	.30	11	7.49	.16	14
2.	1.37	.07	29	1.35	.06	40	1.36	.05	19	1.21	—	1	1.31	.03	5	1.41	.07	11	1.48	.05	17
3.	1.42	.06	29	1.41	.05	38	1.41	.04	19	1.28	—	1	1.36	.03	4	1.46	.07	11	1.44	.06	16
4.	.74	.04	29	.76	.04	40	.74	.03	19	.67	—	1	.77	.04	5	.73	.09	11	.76	.09	17
5.	.45	.03	29	.48	.04	44	.46	.03	19	.41	—	1	.48	.05	5	.42	.09	11	.46	.03	17
6.	3.31	.12	13	3.36	.10	20	3.38	.12	7	3.13	.03	7	—	—	0	3.36	.13	7	3.52	.04	10
7.	2.65	.13	13	2.69	.07	20	2.70	.08	7	2.60	.08	8	—	—	0	2.81	.13	7	2.84	.07	10
8.	.75	.06	29	.75	.04	39	.75	.04	19	.69	—	1	.77	.01	5	.76	.03	11	.80	.03	17

3b. Not as above ..... *M. foina*

4a. Width of inner lobe of P^4/width of trenchant part of P^4 less than .74; lingual length of M^1/width of M^1 less than .66 ..... *M. americana*

4b. Not as above 5

5a. Canine width/bulla length more than 1.09; labial length of M^1/lingual length of M^1 more than .77 ..... *M. melampus*

5b. Not as above 6

6a. Width of inner lobe of P^4/width of trenchant part of P^4 more than .80; labial length of M^1/lingual length of M^1 more than .72 ..... *M. Martes*

6b. Not as above ..... *M. zibellina*

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IRIS PSEUDACORUS L. ESCAPED FROM CULTIVATION IN CANADA*

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The yellow-flowered iris, *Iris pseudacorus* L., which is a native of Europe, North Africa and Syria, was introduced sparingly into Canada as a garden ornamental. It has, however, like the more widely cultivated blue flag, lost favor in the eyes of the grower because of the much more showy garden varieties that may now be obtained commercially.

Iris pseudacorus has escaped to swamps and other moist habitats, where it makes brilliant yellow displays during late June and early July. In most areas the first plants probably have arisen from rhizomes discarded or otherwise removed from nearby gardens. Subsequent spread has resulted from the breaking up of rhizomes or from seed, which is produced in abundance. In some places this iris has spread to such an extent and forms such a scattered pattern that it has the appearance of a native plant.

Specimens from the following herbaria have been recorded: Canada Department of Agriculture, Ottawa (DAO); National Museum of Canada, Ottawa (CAN); University of Toronto (TRT); and Ontario Agricultural College, Guelph (OAC). According to these records *I. pseudacorus* is known from Newfoundland, Nova Scotia, Prince Edward Island, Quebec, Ontario, Manitoba and British Columbia. The specimens known to the author are as follows:

Nfld.: One large colony, brooks, rills and shallow pools between Quiddy Lake and Middle Cove, *Fernald and Wiegand, 5194*, Aug. 2, 1911 (CAN).

N.S.: DIGBY CO.: Edge of pond, far from houses, Pond Cove, Briar Island, *J. S. Erskine, 55.173*, June 29, 1955 (CAN); YARMOUTH CO.: Seaside, Ledge Harbour, *Bruce and MacFarlane, s.n.*, June 23, 1951 (DAO).

P.E.I.: PRINCE CO.: A few large colonies, apparently naturalized, lower part of creek in the finer alluvium, Campbellton, *Erskine and Smith 1919*, July 6, 1953 (DAO); QUEENS CO.: A large stand planted in Smelt Creek beside road at Blythe Hurst's, Brackley Point, *D. Erskine, 1846*, June 30, 1953 (DAO); Roadside ditch near Suffolk on St. Peters Road, *Erskine and Messervy, 1807*, June 27, 1953 (DAO).

Que.: STANSTEAD CO.: bord marécageux du lac, Magog, *Marie-Victorin et al., 2003*, 1 juillet, 1943 (CAN).

Ont.: CARLETON CO.: marshy shore of McKay Lake, [Rockcliffe Park, Ottawa] introduced, naturalized, *Breitung, 2572*, June 15, 1946 (DAO); fairly common forming clumps to two feet in diameter in black muck in wet woods and sedge swamp, presumably spread from three to five foot diameter clumps in ditch at rear of house, Carp, *Cody and Van Rens, 11173*, June 16, 1960 (DAO); HALTON CO.: ditch just west of Moffatt,

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Montgomery and Shumovitch, 87, June 16, 1952 (OAC); LAMBTON CO.: along St. Clair R. margin, Walpole Id., *Gaiser, 1318 W*, June 20, 1958 (OAC); LEEDS CO.: among *Calamagrostis, Typha* and sedges in marsh along St. Lawrence River east of Rockport (13 miles W of Brockville), *Cody and Dore, 11103*, June 9, 1959 (flowering) and *Cody and Spicer, 11295*, Sept. 23, 1960 (fruiting) (DAO); LINCOLN CO.: Jordan Harbour, *Harrison, s.n.*, June 17, 1940 (OAC); MIDDLESEX CO.: wet river flats, 2½ miles NE of Mount Brydges, *Minshall, 4181*, June 1, 1957 (DAO); reported by Judd (1953) in Delaware Twp. along the Thames R. downstream from London; NORFOLK CO.: reported verbally by W. M. Bowden as introduced by him from United States to the swamp at Turkey Point on Lake Erie; and recorded by Landon (1960) from swamp near Simcoe; RUSSELL CO.: ten clumps to two feet in diameter in low wet ground in corner of pasture by roadside in partial shade of *Ulmus americana*, ½ mile N of Clarence on old Highway 17 (25 miles east of Ottawa), *Cody, 11184*, June 29, 1960 (DAO); very common in 1 foot of water of stagnant swamp ½ mile west of Clarence on new Highway 17, *Cody, 11185*, June 29, 1960 (flowering) and *Cody and Van Rens, 11241*, Aug. 18, 1960 (mature specimen with pendent capsules) (DAO); WATERLOO CO.: one large clump well established, Millrace, Conostoga, *Montgomery, 541*, June 17, 1940 (OAC, DAO); along banks of Grand R., Galt. *Montgomery, 633*, June 13, 1953 (OAC); WENTWORTH CO.: Burlington Beach off No. 2 bridge, *Shumovich, 629*, June 13, 1953 (OAC); YORK CO.: low wet land, Woodbridge, *Moffat, s.n.*, 1/7/46 (OAC); High Park, Toronto, *Owens, s.n.*, June, 1950 (TRT); marshy border of Humber R. E-side stream north of Baby Point, Toronto, *McCrea, s.n.*, 3 June, 1941 (TRT).

MAN.: roadside near garden, escaped, St. Francois-Xavier, 12 miles west of Winnipeg, *Scoggan, 10669*, June 16, 1953 (CAN).

B.C.: bord de la rivière à Maple Bay, Duncan, *Marie-Jean-Eudes, 5044*, 17 juin 1948 (DAO); in ditch all along road 2 miles east and 4½ miles south of Chilliwack, *Faris, 43*, May 26, 1954 (DAO).

Iris pseudacorus L. var. *mandschurica* Hort., which has pale-yellow flowers, has been found growing with the typical bright, yellow-flowered form at two localities. It has not previously been recorded as growing outside cultivation in Canada.

ONT.: CARLETON CO.: four clumps to two feet in diameter growing with the typical yellow form in black muck in wet woods and sedge swamp, Carp, *Cody and Van Rens, 11172*, June 16, 1960 (DAO); RUSSELL CO.: rooted in 1 foot of water of stagnant swamp ½ mile west of Clarence on new Highway 17 (25 miles east of Ottawa), *Cody, 11186*, June 29, 1960 (DAO).

The collection of *I. pseudacorus* made by Fernald in Newfoundland in 1911 is undoubtedly the record on which he based the distribution "Nfld. to Minn...." in the eighth edition of *Gray's Manual* (Fernald, 1950), because it was not noted from there in the seventh edition (Robinson and Fernald, 1908) of that work.

Strangely, he apparently did not record the presence of this showy iris as an escape in this province in any of his journal publications on the area.

Fernald (1921) recorded *I. pseudacorus* as "well naturalized about pools and ditches" at Yarmouth, Nova Scotia. Roland (1945) recorded this with the additional information "found at Arcadia over thirty years ago; unknown elsewhere." Our specimens indicate that the species is still restricted to the southern extremity of the province.

The Prince Edward Island specimens cited here are those upon which Erskine (1961) based his report of the species from that province. The Smelt Creek stand was, according to Erskine's notes, introduced by Blythe Hurst in 1939.

Hagmeier (1959) listed *I. pseudacorus* as occurring in New Brunswick. This was probably included on the basis of the broad range given by Fernald (1950) in *Gray's Manual*, eighth edition.

Apparently the only record for Quebec is the one cited above from Magog. This occurrence was recorded by Raymond (1950) in his "Esquisse phytogéographique du Québec." The plant was not recorded in 1935 by Marie-Victorin in his *Flore Laurentienne* but Rouleau listed it in his *Supplement à la Flore Laurentienne* in 1947; the record is presumably based on a duplicate specimen from Magog preserved in the Marie-Victorin Herbarium at Montreal.

The yellow iris is now known to be established in 12 counties in Ontario and it is in this province that it seems to be most widespread. Montgomery (1956) stated that the plant was "sometimes found along streams where it has been thrown out of gardens, or where rhizomes have been carried by spring floods from low lying gardens." He did not, however, give any indication of the extent to which it might invade and take over a wet or swampy area. The label data on some of our recent collections indicates that this invasion is extensive in some areas.

The Manitoba specimen collected from St. Francois-Xavier is the basis for the only record in Scoggan's *Flora of Manitoba* (1957). In 1959, after receiving from Dr. Scoggan exact directions as to where to find it, Dr. Bernard Boivin searched diligently for this plant; but unfortunately the road allowance where it had been collected had been extended and the plant was not to be found. Dr. Boivin reported, however, that the yellow iris was maintaining itself around the houses of many of the farmers in the area and that there was little doubt but that this species would again be picked up as an escape.

Eastham (1947) in his supplement to the "Flora of Southern British Columbia" stated that *Iris pseudacorus* was well-established and spreading in ditches at Sardis. In addition to the two new records for that province, which are cited above, there is a specimen (*H. Groh, s.n.*, 2/6/31), in our herbarium (DAO) collected at Agassiz, which bears the additional label annotation "transplanted from Sardis." There is no indication of whether this plant was considered to be growing under cultivation or not.

The earliest record of the occurrence of this species in the wild is Fernald's specimen from Newfoundland collected in 1911. The statement by Roland (1945) would indicate that it was known as an escape in Nova Scotia at least as

early as 1915. The specimen collected by Mr. Groh at Agassiz, British Columbia, indicates that this iris was established at Sardis in 1931. The earliest dates for Prince Edward Island, Quebec, Ontario and Manitoba are 1939, 1943, 1940 and 1953 respectively.

Iris pseudacorus has become established in Canada, and particularly in Ontario, apparently very rapidly. The extent and rate of future invasions of our low-lying lands and swamps by this very showy species will be most interesting to follow.

Thanks are here extended to Dr. W. G. Dore who kindly examined and recorded the specimens in the herbaria at the Ontario Agricultural College and the University of Toronto.

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SUBSPECIATION IN THE SMITH'S LONGSPUR, *CALCARIUS PICTUS*

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ON APRIL 18, 1949, Ronald Austing, Worth Randle, and the writer collected four Smith's Longspurs at the Oxford Airport, Butler County, southwestern Ohio. Intensive field work in succeeding years led to the discovery that this species is a regular transient each spring at this airport. In considering the problems raised by its migration through this area, the writer wondered whether or not a careful study of the species would show the existence of one or more subspecies, as in the case of the Lapland Longspur, *Calcarius lapponicus*.

In November 1958 this possibility was discussed with Dr. John W. Aldrich of the U.S. Fish and Wildlife Service. A preliminary on-the-spot examination indicated the existence of two races, but it was clear that additional material would be required for a thorough study. During the spring and summer of 1959, through the gracious co-operation of nine museums in Canada and the United States, the writer was able to examine 123 specimens taken during the breeding season. These were from 15 localities ranging from northern Ontario to north-central Alaska. In addition, 117 migrant specimens were examined.

The great increase in the number of specimens made it possible to confirm the preliminary impression of the existence of two races, one breeding in Alaska and the other breeding north and west from Churchill. Furthermore, material from the National Museum of Canada and from the Royal Ontario Museum showed clearly that the birds from northern Ontario along the Hudson Bay coast constitute a very distinct third subspecies.

I am indebted to the following institutions and individuals who generously lent material for this study: Dr. John W. Aldrich, U.S. Fish and Wildlife Service; Dr. Emmet R. Blake, Chicago Museum of Natural History; Mr. W. Earl Godfrey, National Museum of Canada; Dr. Brina Kessel, University of Alaska; Dr. R. W. Nero, Saskatchewan Museum of Natural History; Dr. Kenneth C. Parkes, Carnegie Museum; Dr. Charles G. Sibley, Cornell University; Mr. L. L. Snyder, Royal Ontario Museum; Mr. Sam Waller, Little Northern Museum, The Pas, Manitoba; and Mr. Charles J. Guiguet, Provincial Museum, Victoria, British Columbia. I also wish to thank Mrs. Lyle McBride and Miss Nancy Moore for their help.

I am above all deeply grateful to Dr. Harry C. Oberholser for his unflagging interest and constant keen understanding. These added immeasurably to the pleasure and satisfaction of the study.

Color names are based on Ridgway's *Color Standards and Color Nomenclature*.

***Calcarius pictus pictus* (Swainson)**

(Figure 1, *B*)

Emberiza (*Plectrophanes*) *picta* Swainson, *in* Swainson and Richardson, Fauna Boreali-Americana, Vol. 2, p. 250, 1831 (Feb., 1832) (Carlton House, Hudson Bay Terr.).

Plectrophanes smithii Audubon, Birds Amer., Octavo ed., Vol. 7, p. 336, pl. 487, 1844 (near Edwardsville, Madison Co., Illinois).

FIGURE 1. Smith's Longspurs, adult males: (A) *Calcarius pictus mersi*, (B) *C. p. pictus* and (C) *C. p. roweorum*. (Photograph by G. Ronald Austing)

DESCRIPTION *Adult male in breeding plumage:* Head black, with a broad superciliary stripe extending to the hind neck, and an auricular spot, white; upper surface of body and nuchal collar, buff to tawny olive, centers of feathers, with tail and wings, dark brown to black, and three outer rectrices partly white; lower surface clay color, the throat somewhat paler. *Adult male in winter:* Head like upper surface; throat and jugulum with brown streaks. *Adult female:* Like the winter male.

MEASUREMENTS *Adult male* (forty-eight specimens): Wing, 89.00-96.00 (average, 92.30) mm; tail, 57.00-67.00 (63.21); exposed culmen 10.20-10.90 (10.50); tarsus, 19.80-20.30 (20.10). *Adult female* (thirty-three specimens): Wing, 84.50-92.00 (87.61); tail, 57.00-63.00 (60.33); exposed culmen, 10.20-10.90 (10.50); tarsus, 19.80-20.30 (20.10).

GEOGRAPHIC DISTRIBUTION Breeds north to central northern and northwestern MacKenzie, northern Yukon, and possibly extreme northeastern Alaska; west to extreme northeastern Alaska (possibly), and northwestern British Columbia (probably); south to south-central MacKenzie and northeastern Manitoba; and east to northeastern Manitoba and southeastern Keewatin. Casual in summer in central eastern Keewatin (Repulse Bay). In migration ocurs west to central British Columbia and Alberta and east to Ohio. Winters north to Illinois (probably this subspecies) and Kansas; and south to northern, probably also southeast-central, Texas, and casually (probably this subspecies) to northwestern Louisiana and central-northern South Carolina.

REMARKS Two technical names have been proposed for this species. It was therefore necessary to determine to which population the type specimen, taken by Thomas Drummond in the spring of 1827 at Carlton House, belongs. I have been informed by Dr. C. Stuart Houston, through the kindness of Mr. W. Earl Godfrey of the National Museum of Canada, that the site of old Fort Carlton is 3¾ miles north, and 1¾ miles west of the present town of Carlton in the Province of Saskatchewan. It was also necessary to determine to which population the specimen, taken by Audubon in the spring of 1839, near Edwardsville, Madison County in southwestern Illinois, should be referred. The former bird was described as the type by Swainson in *Fauna Boreali-Americana*, under the name *Emberiza picta*, the Painted Buntling [so spelled]. The type was last known to be in England, presumably in the collection of Cambridge University. Fortunately, there is an excellent plate in *Fauna Boreali-Americana*. Audubon's type is in the United States National Museum in Washington.

Dr. Oberholser, who examined with me all the material sent, offered to examine Swainson's plate and also Audubon's type. On October 7, 1959, Dr. Oberholser wrote me: "Fortunately I was able definitely to identify the two names that have been applied to the species, and both clearly belong to the Churchill race." This means that since the Churchill bird thus becomes the nominate form, both the Ontario and north-central Alaska populations represent previously undescribed subspecies.

SPECIMENS EXAMINED ALASKA. Indian Creek (2), July 15, 1921. ALBERTA. Beaverhill Lake (1), Aug. 28, 1925. BRITISH COLUMBIA. Haines Road, Mile

FIGURE 2. *Calcarius pictus mersi*, probably five or six days old, showing (A) ventral, (B) dorsal and (C) lateral aspects. Molt into juvenal plumage has begun but nearly all natal plumage remains. (Photograph by G. Ronald Austing)

85 (1), July 17, 1944; Tupper Creek (1), May 27, 1937. MACKENZIE. Ft. Simpson (3), May 21, 25, 1860, May 20, 1904; Ft. Good Hope (1), May 31, 1862; Ft. Anderson (1), June 21, 1865; Hansens Creek (1), July 27, 1942; Aklavik (1), May 26, 1942; Kendall Island (1), July 8, 1942. MANITOBA. Churchill (57), (Inclusive dates May 6, 1932–Aug. 15, 1930), May 31 (1), June 1 (3), June 4 (1), June 6 (2), June 7 (1), June 9 (3), June 11 (1), June 12 (2), June 17 (1), June 25 (1), June 28 (1), June 29 (1), July 1 (1), July 2 (2), July 12 (1), July 13 (2, 1 adult, 1 juv.), July 14 (1), July 16 (2), July 19 (4), Aug. 6 (2, 1 adult, 1 juv.), Aug. 15 (1); Oak Lake (2), Sept. 15, 1921; The Pas (1), May 24, 1957; Whitestone Lake (1), May 24, 1924; Whitewater Lake (4), May 4, 13, 1925. SASKATCHEWAN. Indian Head (1), May 14, 1892. YUKON. Old Crow River (5), July 13, 1925, July 14, 1926. ILLINOIS. Adams County (1), March 14, 1889; Morgan Park (1), March 23, 1896; Worth (2), May 3, 1893, April 27, 1893; Riverdale (1), April 3, 1875. KANSAS. Hamilton (3), Feb. 3, 1913. NORTH DAKOTA. Ft. Union (1). OHIO. Oxford Airport, Oxford (5), March 19, 1955, March 23, 1953, Apr. 2, 1951, Nov. 15, 1958. TEXAS, Gainesville (2), Feb. 9, Nov. 19, 1878.

Calcarius pictus mersi, new subspecies

(Figure 1, *A;* Figure 2)

SUBSPECIFIC CHARACTERS *Adult Male:* Similar to *Calcarius pictus pictus*, but light and dark areas of upper surface more contrasted, the former paler, even whitish, the latter less brownish, more clearly black; lower parts much paler throughout. *Adult female:* Upper surface lighter, more grayish or whitish (less brownish or buffy); lower parts decidedly paler, more grayish. There is apparently no significant difference in size. *Natal plumage:* Male. Down of pileum light ivory yellow, slightly tipped with dark mouse gray; wings, back, and posterior parts pale cartridge buff, a little tipped with dull brown.

MEASUREMENTS *Adult male:* Wing, 87.00-97.00 (average, 91.46) mm; tail, 59.00-64.50 (62.66); exposed culmen, average 10.45; tarsus, 20.30. *Adult female:* Wing, 84.50-91.00 (87.78); tail, 55.00-62.00 (59.03); exposed culmen, average 10.45; tarsus, 20.20.

TYPE Adult male, No. 32952, National Museum of Canada, Little Cape, Ontario; July 31, 1947; D. M. Mackenzie.

GEOGRAPHIC DISTRIBUTION Breeds in northern Ontario; known at present from three localities along the Hudson Bay Coast. Winters south to southwestern Kansas (Hamilton County).

REMARKS This surprisingly distinct race is an unexpected product of the present investigation. It represents the eastern pale end of a cline that becomes darker toward its termination in Alaska. Interestingly enough this color cline is just the opposite of that occurring in the closely related species *Calcarius lapponicus*.

Figure 2 shows a young bird, apparently 5 to 6 days old, just beginning to molt from the downy stage to the juvenal plumage, with nearly all its natal plumage still remaining. Since it is the only specimen of the species known in natal plumage, it justifies the description above given. It was collected by

T. M. Shortt on July 3, 1948, at Cape Henrietta Maria, Ontario, and is now in the Royal Ontario Museum.

The only record of this race outside its breeding range is from Hamilton County, Kansas, where it probably winters.

Concerning the locality of Little Cape, Ontario, Mr. W. Earl Godfrey writes: "This is a promontory situated 75 miles west of Cape Henrietta Maria, between the latter and Winisk, just east of the estuary of Sutton and Kinushseo rivers".

I take great pleasure in naming this previously undescribed subspecies in honor of Mr. Wm. H. Mers, for many years an ardent supporter of the ornithological work at the University of Cincinnati.

SPECIMENS EXAMINED KANSAS. Hamilton (1), March 21, 1914. ONTARIO. Ft. Severn (8), June 22, 27, July 1, 19, 1940; Cape Henrietta Maria (26), July 2, 3, 5, 7, 8, 9, 12, 14, 23, Aug. 10, 1948; Little Cape (11), July 29, 31, Aug. 1, 1947.

***Calcarius pictus roweorum*, new subspecies**

(Figure 1, *C*)

SUBSPECIFIC CHARACTERS *Adult male:* Resembling *Calcarius pictus pictus*, but darker, this particularly evident on the edgings of back feathers, tertials, nuchal collar, and lower parts. *Adult female:* Likewise darker on feather margins of upper parts and decidedly so on the whole of the lower surface.

It is a great pleasure to name this race in honor of Mr. Stanley M. Rowe, Sr., and Mr. Stanley M. Rowe, Jr., both of whom have substantially supported the ornithological work as well as other activities at the University of Cincinnati.

MEASUREMENTS *Adult male:* Wing, 89.00-96.00 (average 92.33) mm; tail, 60.50-67.00 (64.57); exposed culmen, average 10.50; tarsus, average 20.25. *Adult female:* Wing, 84.00-90.00 (average 87.56); tail, 56.00-63.00 (58.62); exposed culmen, average 10.40; tarsus, average 20.10.

TYPE Adult male, No. 435538, U.S. National Museum; Anaktuvik, Alaska; June 4, 1949; Tom Brown.

GEOGRAPHIC DISTRIBUTION Breeds in northeast-central Alaska. In migration occurs west to Albreta and northwestern North Dakota; and east to Indiana and Ohio. Winters north to Iowa and Kansas; and south to northeastern Texas and northwestern Louisiana (probably).

REMARKS This is the darkest form of the species. Like *Calcarius p. mersi*, it occupies a much smaller breeding area than does the nominate race.

SPECIMENS EXAMINED ALASKA. Anaktuvik River (2), June 4, 1949; Giant Creek (1), June 2, 1952; Contact Creek (1), June 20, 1951; Sheenjek River (near junction with Old Woman's Creek) (2), June 6, 1956; Sheenjek River (1½ miles north of Old Woman's Creek) (1), June 6, 1956; Summit (2), June 3, 9, 1952; Tolugak Lake (6), May 27, 28, 29, June 4. 5, 9, 1951. ALBERTA. Beaver Lake (3), May 16, Sept. 4, 6, 1923; Beaverhill Lake (6), May 15, 1923, Aug. 24, 25, 1925; Chipewyan (2), Sept. 1, 3, 1920; Lac La Nonne (2), Sept. 7, 31, 1926; near Metiskow (1), Sept. 13, 1920; Tofield (1), Sept. 9, 1925. MACKENZIE. Ft. Simpson (10), May 24, 1860, May 25, 1862, May 18, 20, 21, 1904; Hay River, Great Slave Lake (1), May 12, 1908. MANITOBA. Churchill

(7), May 31, 1931, June 4, 1931, June 4, 1932, June 6, 1931, June 6, 1932, June 10, 1933; Deer Lodge (2), May 18, 1930, Aug. 22, 1932; The Pas (1), May 12, 1952; Rockwood (1), Sept. 8, 1932; Springstein (1), May 13, 1905; Whitestone Lake (6), May 11, 12, 13, 16, 19, 1924; Whitewater Lake (7), May 12, 1924, May 13, 1925. ONTARIO. Port Arthur (1), Sept. 1892. SASKATCHEWAN. Craven (2), Sept. 8, Oct. 1, 1913; Indian Head (1), Sept. 11, 1891; Lake Athabaska (1), Aug. 17, 1920; Lake Mountain Lake (1), Sept. 15, 1932. ILLINOIS. Beecher (1), May 3, 1953; Morgan Park (1), May 2, 1896; Riverdale (2), March 31, 1875; Worth (1), May 3, 1893. INDIANA. Jasper County (2), April 24, 1955. IOWA. (1), Oct. 1, 1872. MINNESOTA. Pembina. NORTH DAKOTA. Ft. Union (1); Souris River (1), Oct. 1, 1893. OHIO. Grand Lake (1), April 3, 1954; Oxford (14), April 18, 1949, April 20, 1950, April 5, 1952, April 3, 17, 20, 24, 1954, March 19, 1955, April 14, 1956, March 30, April 30, 1957, April 20, 1958. OKLAHOMA. Tulsa (2), Nov. 30, 1934, Feb. 2, 1935. TEXAS. Rice, Navarro Co. (1), Nov. 26, 1880; Gainesville (1), Feb. 28, 1879.

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NOTES ON THE HERPETOFAUNA OF THE DELTA MARSH OF LAKE MANITOBA, CANADA

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DURING the summer of 1958 the author was in residence at the Delta Waterfowl Research Station, Delta, Manitoba, and collected specimens and made observations on the herpetofauna of the extensive Delta Marsh of Lake Manitoba. This is the first such study of the region, and 33 specimens of seven species were collected. Although the species discussed below have been recorded from other localities in Manitoba, the large number of amphibians in the area afforded an excellent opportunity to obtain notes on activity cycles, breeding habits and general ecology.

The study area is approximately 50 airline miles northwest of Winnipeg and part of the lakebed of glacial Lake Agassiz. Two low wooded sand-beach ridges separate Lake Manitoba from the Delta Marsh, an area of large open bays, small isolated sloughs and potholes. The bays and sloughs are bordered by bulrush and cattail, but the dominant marsh plant is phragmites, which occupies large areas in shallow open water. In landlocked and stagnant areas of the marsh, duckweed growth is extensive. The mean annual temperature at Delta is 35° F; summer temperatures are above 100° F and winter temperatures of −35° F are common. Seventy per cent of the mean annual precipitation of 22 inches occurs during the months of May to October. The mean hours of sunshine for the months of June, July and August are 250, 294 and 263, respectively.

The list of species includes six amphibians and one reptile. Specimens are in the Natural History Collection of The University of Texas, Austin, Texas. The author expresses appreciation to H. A. Hochbaum, Director, Delta Waterfowl Research Station, and to his staff for their assistance.

GRAY TIGER SALAMANDER *Ambystoma tigrinum diaboli* Dunn. This is the only urodel in the Delta Marsh. A specimen was taken under a board at Delta on July 21, but diligent searching did not reveal others. According to local residents large numbers of salamanders are seen in August, their appearance coinciding with high temperatures and heavy rains. After the middle of July 1958, however, only traces of rain were recorded at Delta; lack of moisture combined with high temperatures in late July and August may have inhibited their emergence.

DAKOTA TOAD *Bufo hemiophrys* Cope. The only bufonid amphibian in the region, this toad is widely distributed throughout all habitats of the marsh area. Spring emergence occurred on March 28, and loud choruses were heard in stagnant breeding ponds in April and May. Tadpoles were common in shallow areas of the marsh in June, and the first metamorphosed toads were seen on June 23. On July 5 snout-vent length of 10 young toads averaged 11.3 mm. By August 11 these toads had doubled in size, and the average measurement of 16 was 26.1 mm. In early September young adults and adults had abandoned the marshes and gone into hibernation, and the only active group was the young of the year.

On the afternoon of June 8 six specimens were taken from the marsh between the two beach ridges of Lake Manitoba. The water was stagnant and covered with duckweed, and at the time of capture the females had moved to the higher wet banks and only males were found in the water. On June 19 an additional specimen was taken with a young adult *Peromyscus maniculatus* under a board on the south shore of Cadam Bay, the largest area of open water in the Delta Marsh.

EASTERN GRAY TREEFROG *Hyla versicolor versicolor* LeConte. Although not frequently seen, the presence of this species was indicated by its occasional call. Two specimens were taken half a mile east of Delta during the night of June 16 from a landlocked stagnant pond surrounded by thick willows. Daily rainfall recorded from June 13 through 25 varied from only traces on five days to 0.45 inch on June 24, and during this time isolated tree frogs were heard during the daytime from heavily wooded ponds and shallow marshes near Delta. After late June and the advent of higher temperatures and increased daylight none were seen or heard.

BOREAL CHORUS FROG *Pseudacris nigrita maculata* Agassiz. In southern Manitoba unseasonably warm temperatures were experienced in early spring, and by March 28 ice had melted in most areas. Although the air temperature was only 33° F on this date, many were heard calling from roadside ditches near Headingly, west of Winnipeg, in the afternoon. After heavy breeding in April and May, none were heard to call again at Delta until July 5. They were abundant in shallow marshes and roadside ditches near Delta but were never heard or seen in the stagnant, deeper portion of the Delta Marsh frequented by *Bufo hemiophrys*.

On July 5 a specimen was taken 4 miles south of Delta from a roadside ditch, and on July 6 five were taken from a shallow cattle pond 3 miles south of Delta. On July 8 a specimen was obtained from a roadside pond 20 miles south of Dauphin, and chorus frogs were heard at numerous localities in Riding Mountain National Park on July 7 and 8 when high temperatures were about 70° F and the low about 50° F. In late July and August, when air temperatures were above 70° F, calling was not heard at Delta.

WOOD FROG *Rana sylvatica* LeConte. This species was common in shallow-grass areas bordering the marsh and was also often seen on the beach ridges and in farmlands south of Lake Manitoba. They were evident all hours of the day and night but were never active when air temperatures were below 45° F. Three specimens were taken on June 10 in a pasture 5 miles east of Delta, and one was collected from a roadside ditch 3 miles southwest of Clarkleigh on the southeast shore of Lake Manitoba. In Riding Mountain National Park they were abundant in pools frequented by *Rana pipiens* and *Pseudacris nigrita*, and on July 8 one was taken from a roadside pool 20 miles south of Dauphin.

LEOPARD FROG *Rana pipiens* Schreber. This was the most abundant frog of the region. It was plentiful in the marsh, roadside pools and ditches and was often seen on the beach ridges in associations with *Rana sylvatica* and *Bufo hemiophrys*. The wood frog and the leopard frog seemed to have a similar ecological distribution, but only the leopard frog and the Dakota toad were seen at night on the beaches of Lake Manitoba. One specimen was taken from the beach at Delta on June 4, and another on June 10 from a small grass pasture 5 miles east of Delta.

WESTERN PLAINS GARTER SNAKE *Thamnophis radix haydeni* Kennicott. This snake was the only reptile in the area and was abundant in moist to semi-moist situations of the marsh where phragmites, cattail, barley grass and alkali grass formed dense growths. They were often seen in peripheral habitats where frogs and toads were ubiquitous, but were never observed in the water of the marsh. On July 9 a small specimen was collected 4 miles south of Delta from a grass pasture while it was eating a juvenile Dakota toad. The air temperature was 70° F. The snake took 25 minutes to ingest the anuran. The large population of amphibians in the area undoubtedly insured a ready food supply.

On July 1 two pregnant females were collected 3.5 miles south of Delta from grass at the edge of a plowed field. One measured 957 mm and contained 76 embryos. The other, measuring 953 mm, contained 63 embryos. Neither snake had food in the stomach or intestine. Six additional specimens were taken from semimoist grassy areas near Delta during June and July.

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DISPLAYS OF THE SPRUCE GROUSE

HARRY G. LUMSDEN
Ontario Department of Lands and Forests, Maple, Ontario

BETWEEN May 16 and 18, 1960, I had the opportunity of studying some of the behavior patterns of Spruce Grouse, *Canachites canadensis*, in northern Ontario.

The area in which the observations were made is eleven miles north of Geraldton, close to the Geraldton-Nakina Road. It consisted of a stand of over-mature jack pine, *Pinus banksiana*, in which regeneration of younger jack pine and white spruce, *Picea glauca*, had taken place. This understory was from three to thirty feet high. The site sloped gently to the west and bordered a swamp containing black spruce, *Picea mariana*. Ground cover in openings in the pine stand was sparse, and lichens, *Cladonia* sp., were abundant. In the black spruce swamp a dense growth of Labrador tea, *Ledum groenlandicum*, dominated the hummocks of the forest floor.

Times of observations are given in Central Standard time.

I wish to acknowledge the assistance of Mr. J. Goddard, District Biologist, and Mr. J. A. Macfie, Senior Conservation Officer, both of the Department of Lands and Forests, Geraldton District, who helped in a search for spruce grouse and assisted in manipulating the mounted specimen and mirror while I made notes and took photographs.

FLUTTER-JUMP DISPLAY

The flutter-jump display of the Spruce Grouse has been described by a number of authors. Some of the best descriptions are worth repeating here because the display seems to be very variable in form.

> The male flew straight up as high as the surrounding trees about 14 feet; here he remained stationary an instant and while on suspended wing did the drumming with the wings, resembling distant thunder, meanwhile dropping down slowly to the spot from where he started. Bendire (1892)

> His favourite location at such a time is between two trees standing apart some twenty or thirty feet and with their lower branches large and horizontal. Perched on one of their branches he pitches downward pausing midway to beat and flutter his wings and ascends to a branch of the opposite tree. . . . Selecting a small open space among the bushes he takes his stand in the centre and like a jack-in-the-box pops up a few feet in the air and giving his triumphant flutter drops to earth. DeVany (1921)

> From his station on one of the perches at the end of the arena the bird flew in a natural manner to the other end. At about two or three feet above the opposite landing place he checked his flight abruptly by spreading his tail and tipping his body almost to a perpendicular position – then with whirring wings dropped to the ground. . . . After standing for a few moments the bird turned about and craned his neck a few times at the perch almost directly over his head. He then took off on vigorously beating wings which carried him straight into the air to a point on a level with it and moving forward settled on the twig. One bird had the habit of rising to the level of the

perch facing away from it then turning about in mid-air and alighting. Breckenridge in Roberts (1936)

. . . he drums also, making a sound somewhat like the more rapid part of the drumming of the Ruffed Grouse but less loud and resonant. This sound is produced by the wings, which beat upon the air with quick nervous strokes while the bird is fluttering up ten or fifteen feet into a tree, or flying down from a branch. He has been seen to drum also while climbing the leaning trunk of a tree, while hovering in the air, and while merely flying up or down to or from the top of a stump. The usual flight of an unhurried Spruce Grouse is rapid and comparatively noiseless. The bird has been seen to start up silently from the ground and to drum during the latter part of the flight, and occasionally he drums when leaving the ground but stops before the flight is completed. Forbush (1927)

On May 17, 1960 at 4.30½ a.m. I heard a cock Spruce Grouse performing flutter jump displays and later found him on the ground near a clump of young jack pines. The morning was warm and calm with about 4/10 cloud.

Between 4.31 a.m. and 4.56½ a.m. he performed eleven flutter jumps, flying from the ground steeply to jack pine branches from six to twenty feet above the ground and down again. Seldom was the same branch used twice, and the bird did not seem to have any special point on which he regularly landed, although he landed more often on snow than on bare ground.

The flight upwards into a tree was performed normally without any attempt to hover or pause with rapidly beating wings before settling. Periods spent in the tree before flying down to the ground were approximately as follows: twelve seconds, ten seconds, ten seconds, fifteen seconds, twenty seconds, thirty seconds, twenty seconds, seven minutes thirty seconds, forty-five seconds, and four minutes. Thus, of this period of display activity, about fourteen minutes thirty-two seconds out of twenty-nine minutes thirty seconds were spent in the branches of the trees.

During the four-minute period in a tree the bird did some feeding but he sat still during the seven-minute thirty-second period.

The periods spent on the ground were less variable than those spent in the trees and were usually a little over one minute. During this period the bird stood or walked in the strutting attitude illustrated in Figure 1; once he performed a display to be described in detail later under the heading "tail-flick display."

The descent from the tree to the snow drift or the ground was always carried out in a characteristic manner. The bird flew down steeply, but apparently normally, until about four to six feet above the ground. The body was then swung into an almost vertical position, the tail fully spread, and the bird descended on rapidly beating wings very steeply to the ground.

I could detect no specialized sound produced by the primaries and no vocal calls.

I did not see any other Spruce Grouse in the vicinity of the displaying male during his performance, and no male could be heard displaying similarly in the distance. It is possible that I disturbed the bird and elicited this response

but it is more likely that the combined effect of the absence of female Spruce Grouse and the male's physiological condition stimulated this display, the function of which is probably territory advertisement.

Three different openings in the forest located some twenty and sixty yards apart were used by cock Spruce Grouse for flutter-jump displays. I believe that the same bird used each of these display areas. Although no birds in the area were marked so that they could be individually distinguished, the type of advertising display was the same in each case. This particular bird seldom flicked his wings in the manner described by Roberts (1936) and Harper (1958).

Head and Tail-down Display

On May 16 a male was located at 12.25 p.m. and flushed towards the south. He settled on the ground after a flight of about fifty yards. A second male appeared close by and they ran towards each other and disappeared among a dense growth of Labrador tea.

Although only about ten yards away, I could not see the behavior of the birds except when one fluttered into the air in combat. During this encounter a characteristic series of calls was heard, which will be described later. After about fifteen seconds, one bird could be seen chasing the other and for the next half hour the two remained within five yards of one another with one moving away whenever the other approached. No other aggressive behavior was observed.

During the evening of May 17, about 8.15 p.m., some experiments with a mirror were carried out with a male in a clearing that had been used previously for flutter-jump displays. The bird had assumed the strutting posture illustrated in Figure 1 when he was presented with the mirror so that he could see his reflection. Immediately he lowered his tail to a position just below the horizontal, and with extended neck and feathers no longer ruffled but held close to the body, he ran towards his image. This posture was similar to that adopted by the Ruffed Grouse when attacking a rival (Bump, 1947). As he ran, he uttered a series of calls and during each call he spread his tail feathers and retracted them just enough to make a distinct rustling sound. The calls sounded like a harsh hissing and can be imitated by constricting one's throat and exhaling sharply. Each time the bird performed this display, the sequence of calls followed the same pattern: two calls uttered half a second apart and then five uttered in very quick succession for about one and a half seconds. On reaching the mirror the bird pecked at his reflection several times. The blows seemed to be aimed at his head, although under the circumstances it was not possible to be sure. The combs were fully expanded and lay like two crimson rolls, one above each eye, projecting well above the top of the head. The bird was not particularly vigorous in attacking his reflection; after a few pecks he would move to the side as if circling his foe. This, of course, placed him in a position where he could no longer see his reflection; he then often moved forward slightly, giving the impression that he was searching behind the mirror for his opponent.

FIGURE 1. Front and rear view of a strutting Spruce Grouse.

When a study skin of a male was held up in a position similar to that adopted by the live bird when attacking the mirror and in such a way that the black and white pattern of the throat and breast could be seen, the live bird stood absolutely still until the skin was removed and looked at it without attacking. The combs on this study skin were dry, shrunken, and discolored. Watson (1956) has drawn attention to the role of the comb as a sex recognition signal and an indication of aggressive intent in the Rock Ptarmigan. It may be that the comb in the Spruce Grouse has a similar function. Since the bird neither ignored the study skin nor attacked it, it seems likely that an incomplete stimulus was present, which failed to precipitate any clear-cut behavior pattern.

STRUTTING DISPLAY

The strutting display of the Spruce Grouse has been described by Bishop in Bendire (1892), Breckenridge in Roberts (1936), and by Harper (1958).

In strutting, the neck was extended and erect, the tail was held at an angle of about 70° above the horizontal and the wings were slightly lowered. The crimson combs above the eyes were distended and stood up above the top of the head. The feathers on the chin and throat were erected so that the bird appeared to have a short beard, although not as long and conspicuous as that of the Capercaillie, *Tetrao urogallus*. The feathers on the crown, on the sides of the head, and on the back of the neck were kept in their normal position while those of the front and sides of the neck and upper breast were erected.

During the experiment with the mirror, the bird ignored us even to the extent of letting me touch and handle him. I could feel that the esophagus was slightly inflated. It seems likely that the erection of the breast feathers is accomplished by this partial inflation and possibly also in part by muscular action. The act of inflation is probably achieved in the same manner as that described by Gross (1928) for the Heath Hen, *Tympanuchus cupido cupido*.

The effect of the erection of these feathers was to increase the apparent width of the bird while at the same time changing his color pattern. The white tips of the feathers on the upper breast appeared as rows of white spots while the bird was at rest. When these feathers were erected the white tips drew closer together so that during high-intensity display a white band appeared across the upper breast. At the same time the black area on the front of the neck was greatly enlarged and intensified. The undertail coverts were also spread during strutting so that they stood out like a fan with their white tips contrasting strongly against the black of the rectrices.

While maintaining this strutting posture the bird stood still for short periods or moved about with pompous tread. As each foot was raised from the ground the outer rectrices on the opposite side were spread with a rustling sound. As the foot was brought forward these feathers moved back to their original position.

Strutting is probably a low-intensity aggressive display and may be a normal preliminary to the tail-flick display. In the situation mentioned above, strutting may have been initiated in a resting male in the first place by our presence. The bird did, nevertheless, maintain the strutting posture constantly

while not otherwise engaged as long as a mount or study skins were left within his field of view.

On the evening of May 17 at about 8.40 p.m. we located a cock in a tree. A mounted female Spruce Grouse was placed on the ground on a small clearing nearby and we moved a few yards away and lay down. After about half a minute the cock flew down and started to strut. Gradually the intensity of his display increased and he occasionally thumped the ground vigorously with his bill. I particularly noted that in this case the bill was kept closed at all times. This behavior would appear to be a "redirected movement" and not "displacement feeding" as discussed by Moynihan (1955). Perhaps it can be interpreted as follows: as the aggressive drive within the bird increased in a setting in which attack upon the object of his attention was inhibited by (1) female plumage pattern and absence of combs, (2) immobility, (3) nonaggressive posture, the strutting behavior pattern no longer provided a satisfactory outlet; the bird then switched to redirected attack pecking aimed at inanimate objects around him.

Tail-flick Display

After some minutes of strutting and pecking, the bird circled the mount and several times performed the following ceremony. It began with the bird moving forward with short rapid steps. Finally he halted, but continued to mark time briefly in a manner similar to that of a Greater Prairie Chicken, *Tympanuchus cupido*, in booming display. Unlike this species, however, he produced no sound with his feet. As he halted, the body was tilted slightly forward so that the rump was held higher than in the strutting posture and the tail was brought into a vertical position. At the same time the bill was pointed down, the head slightly lowered, and the barred feathers on the back of the neck elevated so that they formed a raised cape. The white-tipped and black feathers on the neck and upper breast remained erect. The wings were held close to the body and the primaries horizontal. Suddenly the bird dipped his head slightly and uttered a short harsh hiss then a high-pitched squeak. On this latter note the head was raised and the bill opened. Almost simultaneously the wings were moved outward and downward to a half-open position with the bastard wing extended. Immediately following the hiss and squeak the tail was flicked open and shut so that the rectrices became separated. This produced a scraping noise audible at a greater distance than the vocal sounds. The bird then resumed the normal strutting posture. The upper picture in Figure 2 illustrates the posture assumed immediately before the bird uttered the calls; the posture with the tail fully spread is shown in the lower portion of Figure 2.

Sex Recognition

On May 18 some observations were made on the response of the cock Spruce Grouse to a male and a female study skin of the same species. These specimens were made up in the conventional museum manner with the head and neck slightly extended, the wings close to the body, and the feet crossed under the tail.

FIGURE 2. Tail-flick display postures of the Spruce Grouse.

When the female skin was placed on the ground the bird immediately attempted to copulate with it. He stepped onto the back of the skin, with his bill grasped the feathers on the back of the head and neck, and brought his cloaca into contact with the specimen's rump feathers. On subsequent trials he attempted copulation facing the tail of the skin, and finally actually pulled the tail off. He even attempted to copulate with the skin lacking a tail and when it rolled over belly up because of the unevenness of the ground.

When presented with a study skin of a male Spruce Grouse, with some hesitation he also tried to copulate and continued to do so as long as the specimen was left in view.

On three occasions the bird was given a choice of the two specimens. They were placed side by side in the open near where the cock was standing. On two trials the male study skin was placed deliberately closest to the live bird. In each of the three trials he attempted to copulate with the female skin only.

I have mentioned the discolored condition of the combs on this skin. Without such a conspicuous signal structure on the male study skin, it is not possible to draw very definite conclusions from this experiment. It would appear that sex recognition by plumage characters alone is not very highly developed in the Spruce Grouse, in spite of considerable sexual dimorphism. It was, nevertheless, well enough developed to enable the male under study to distinguish the sexes of study skins when presented with a choice. Sex recognition in the Spruce Grouse is probably normally accomplished largely by posture and movement.

Head-jerk Display

I observed this display on several occasions, and do not fully understand its significance at present: it may be a precopulatory display. Between periods when the cock strutted before the mounted female Spruce Grouse mentioned previously, the bird performed this display, which has been described by Bendire (1892) and Harper (1958). He squatted down before the mount with the rump elevated and tail closed. The feathers on the breast were erected as in the strutting posture and the wings held half open. The head and neck were first held close to the body and then with a sudden movement they were extended upwards, first to one side and then the other. Sometimes brief circular movements were made with the head. At each of the upward movements of the head the tail was flicked open and shut, producing the rustling noise that appears in the tail flick, head and tail down, and strutting displays. No call notes were detected during this display.

Summary

The displays of Spruce Grouse, *Canachites canadensis*, were studied near Geraldton, Ontario, in May 1960. The flutter-jump display, head and tail-down display elicited with the use of a mirror, strutting, tail-flick, and head-jerk displays are described. Experiments were carried out in sex recognition. The cock bird attempted to copulate with both male and female study skins.

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REVIEWS

Most reviewers may be identified on the inside front cover of this issue. The affiliation or address of other reviewers follows the author's name.

Ecology of the Aspen Parkland of Western Canada

By RALPH D. BIRD. Ottawa, Canada Department of Agriculture, 1961. 155 p. $3.00 (Publication 1066)

This book has the refreshing quality of not only presenting information on plants and animals but of showing the influence of man. Each of the two major communities, grassland and forests, are described under the headings of plant and animal components. The forest community is developed more fully under the topics of successional changes and the influence of animals, Indians and fire.

The chronological history of settlement covers the period from 1668 to the present, but probably the most important portion of the book is the discussion of the changes brought about by settlement, the changes in plant dominants, the weed problem and the problem of abandoned land.

There are three maps and 57 fine black-and-white photographs of plants and animals (including insects) and nearly 200 references to floras and faunas and works on a variety of topics from ecology to chemical control. An index is also provided.

Undoubtedly there is a tremendous amount of diverse information packed into these pages, information which must have been accumulated over a considerable period of time. Some of the early portions that describe zones within the aspen region are rather dry reading because of the list of species. But no one could deny that the story of the destruction of the buffalo and the frantic attempts to protect the Whooping Crane, which appear later in the book, make fascinating reading.

I rather felt that there might have been another chapter added which would contain some conclusions or some predictions on the course of succession in the future, but this is left pretty well to the reader. On the whole, Mr. Budd has skilfully brought together much well-documented information clothed in words that hold the interest of the reader.

JOHN M. GILLETT

Bird Songs in Your Garden

Text and photographs by Arthur A. Allen, 25 p.; phonograph record by Peter Paul Kellogg, 12-inch 33⅓ rpm. 1961. Ithaca, Cornell University Records. $5.95.

Here is a double delight: a book to read and look at, a record of bird songs to listen to.

The book has 53 pictures, over half of them in color, carefully written notes on the birds whose songs are recorded, and, as a bonus, helpful information on how to attract birds.

The record presents the songs of 25 birds that frequent the garden, beginning with the morning Peewee and ending with the night calls of the Screech Owl. All songs are characteristic. There is very little stridency in this record of subjects whose vocal capture needs a high degree of technical skill. The same recording is repeated on Side 2, but this time, as we are told, it is "free from human interference."

As a gift for the bird lover, this book and record can be recommended without qualification. As a personal investment their worth can only be limited by the number of times they are used.

ROBERT A. HAMILTON

Canadian Atlantic Sea Shells

By E. L. BOUSFIELD. Ottawa, National Museum of Canada, 1960. 72 p. $1.00.

After a one-generation lapse, the public is becoming nature-minded again, and well-illustrated, reliable and modestly priced manuals on natural-history topics are appearing in our book stalls. Most of these books, however, are United States publications, and those dealing with plants and animals often confuse the Canadian who lives any great distance north of the border area. It is therefore pleasant to discover a little book (almost pocket size and with a durable cover) that deals particularly with Canadian Atlantic sea shells. It is gratifying, too, that its author is so well qualified to deal with this subject. He is Invertebrate Zoologist at the National Museum of Canada.

Dr. Bousfield's principal aim is to interest the amateur who is making his first visit to the Atlantic coast anywhere from the Strait of Belle Isle to the international border. But much of what he says would apply equally well to any part of the New England coast north of Cape Cod. He defines sea shell in a broad sense: "the skeleton of a marine invertebrate animal." Thus he includes most of the interesting things a beachcomber is apt to pick up: snail, clam, chiton and tusk shells, lamp shells, crabs, sea urchins, sand dollars, barnacles, sponges and tube worms. He even stretches his definition to include some starfish. Altogether, he describes 150 species and illustrates 133 with small but clear photographs by F. J. Cook and art work by John Crosby. His emphasis is on the inshore molluscs.

The descriptions are clearly set out and serially numbered and the illustrations are correspondingly numbered. It is easy to identify a specimen from the illustrations and check back to the text to verify the identification. As a further aid, there is a glossary of special terms, a single index including both common and scientific names as well as references to literature that treats the subject in more detail. There are also sections on modes of life of shellfish, zoogeographic zonation of the coast, economic importance of shellfish and how to make and care for a marine shell collection. So, as the author states, there is much in the book for the student and professional conchologist, as well as for the amateur collector. At one dollar it is an excellent investment for any naturalist.

J. C. MEDCOF
Biological Station
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NOTES

First Canadian Record of the Black-throated Sparrow

ON JUNE 8, 1959, Miss Anne Miller, age 7, while playing in a cabin clearing at Murtle Lake, in remote Wells Gray Park, British Columbia, discovered a strange bird feeding on the ground. After noting that it was a sparrow with a black throat and a white line over the eye she went to the house and told her mother who suggested that Anne look it up in a bird book. Soon she was so sure that only one picture, that of a Black-throated (Desert) Sparrow, fitted her bird that her mother, Mrs. Hettie Miller, investigated and found that Anne was right. Mrs. Miller collected and prepared the specimen and has kindly donated it to the National Museum of Canada. It is an adult male Black-throated Sparrow, *Amphispiza bilineata deserticola* Ridgway, the first record of the species for Canada. The fact that the first Canadian specimen was discovered and correctly identified by a seven-year-old girl augurs well for the rising generation of ornithologists!

Murtle Lake is in a heavily forested valley, the floor of which has an elevation of some 3500 feet. About the lake are rounded mountains reaching up to 8000 feet. Climatically the area is characterized by frequent rainfall in summer and heavy snowfalls in winter (R. Yorke Edwards and Ralph W. Ritcey, Can. Field Nat. 73:21, 1959). The Black-throated Sparrow frequented a small clearing in the heavy forest. Its stomach contained insects (apparently mainly Diptera) and bits of gravel.

Other evidence of unusual occurrences of this desert-inhabiting species in the late spring of 1959 is recorded by H. M. Du Bois (Condor 61:435, 1959), who reports its presence in no less than three separate localities in the humid part of southwestern Oregon, and Thomas Rogers (Audubon Field Notes 13:390, 1959), who records another from Baker, Oregon, May 17 to 19, 1959.

I am grateful to Mrs. Hettie Miller for the privilege of recording this interesting occurrence and to Dr. R. Yorke Edwards, Department of Recreation and Conservation, Victoria, B.C., who first drew my attention to the record.

W. EARL GODFREY

National Museum of Canada
Ottawa, Ontario
7 April 1960

House Sparrows Burrowing in Asbestos Insulation

ON JANUARY 13, 1954, a representative of the Atlas Asbestos Company Limited, asked whether the Canadian Wildlife Service could suggest a means of preventing House Sparrows (*Passer domesticus*) from digging in asbestos wall insulation. It was reported that numbers of sparrows were attracted to the insulation for roosting and nest-building purposes.

On January 27, Dr. G. M. Stirrett and I, with Mr. J. Brady of Atlas Asbestos Company, inspected the heating plant of the Kingston penitentiary at Kingston, Ontario. Within the plant we found that the sparrows had dug long interlacing trenches in the asbestos insulation that covered the inside walls and ceiling of the plant (Figure 1). Most of the trenches had enlarged roosting sites every two or three feet. At the time of our visit sparrows were digging and roosting in the trenches and flying back and forth through the open doors of the building. Our attention was drawn to debris on the floor, consisting chiefly of materials such as straw, asbestos fibers and string.

While it was impossible at the time of our visit to confirm that nesting took place in the burrows, we were informed by the plant engineer that this was so.

The insulation material is a mixture of asbestos, Portland cement and water, sprayed on the walls and ceiling in a

semiliquid form that quickly solidifies to form an air-tight, sound-proof and fireproof covering. The activity of the sparrows reduced the life of the insulation and the falling debris created a serious hazard, particularly in aircraft hangers.

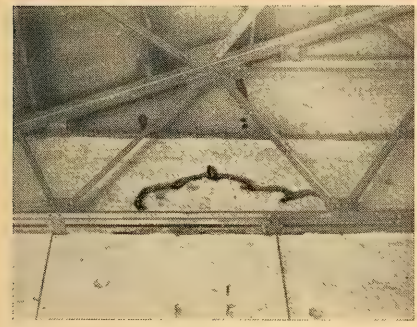

FIGURE 1. Typical House Sparrow Burrow in Wall Insulation

To meet this problem the proposal finally adopted was to spray a hardening material over the insulation. Subsequent observations have indicated that the hard exterior finish prevents the birds from damaging the material.

Behavior similar to that described above is reported by Edwin Way Teale in *Circle of the Seasons* (New York; Dodd, Mead; 1953, p. 261). Teale reported colonial nesting of House Sparrows in straw stacks in Franklin County, Pennsylvania, in 1935. At that time he believed it to be a purely local habit.

Our observations at Kingston suggest that burrowing of House Sparrows in a large mass of nesting material is not necessarily a local habit. It would be of interest to learn whether similar behavior by this species has been noted elsewhere. The habit described here may well reflect an ethological link with other Old World Weaver Finches, some of which construct multiple nests with a common covering.

ROBERT D. HARRIS
Canadian Wildlife Service
6660 Northwest Marine Drive
Vancouver 8, British Columbia
25 November 1960

A Chestnut Tree in Nova Scotia

IN OCTOBER 1959 in the town of Bridgewater, Lunenburg County, Nova Scotia, I recognized a large chestnut, *Castanea dentata*, a tree I had known intimately in Norfolk County, Ontario. The Bridgewater tree stands on Victoria Road in front of an early colonial residence known as the Thompson Place, and is undoubtedly one of the few surviving healthy American chestnuts on this continent.

The diameter of the tree is thirty inches at the ground and twenty four at breast height. Recently Mr. Lief Holt, of the Bowater-Mersey Paper Company, computing with the help of an increment borer, considered that the tree was about 75 years old. This dating compares favorably with the little information that can be gleaned about this tree and precedes the arrival of the chestnut blight in North America. It would appear that some plantings had been made earlier in the town and I have been told of some actual locations which have since gone. Dr. J. F. Hockey and Mr. G. S. Swain of the Plant Pathology Laboratory at Kentville have examined the tree and judged it free of blight.

On October, 5, 1959, there were many burrs, still unopen, on the branches of the crown and some newly fallen were fully grown but very green. All of these and others examined later in the season contained unfilled nuts, but I am assured by those living nearby that some years these are fully developed.

The tree's companions are a linden, a silver maple and a native sugar maple, all of considerable age and possibly set out at the same time.

Dried specimen material and a photograph have been deposited with the Plant Research Institute, Ottawa, for preservation.

J. F. DONLY
Mill Village, Queens County
Nova Scotia
20 April 1960

Mollusks Introduced into British Columbia

IN A RECENT widely distributed memorandum, "The Status of Snails as Agricultural Pests" (Plant Protection Division, Plant Inspection Circular No. 31, 1960), the Canada Department of Agriculture has pointed out the potential danger from the introduction of foreign snails and it has imposed restrictions to prevent their importation. New records of snail introductions are therefore of some importance.

An expert gardener in Lynn Valley, British Columbia, received a shipment of decorative bushes from Eastern Canada in the spring of 1926. During the summer he was surprised to see several banded snails in his garden. By the use of sulphate sprays and poisoned bran he exterminated the snails. He warned his friends and there was no recurrence. Three of the shells that were salvaged indicate that the species was probably *Cepaea nemoralis* Linne.

A more recent accidental snail introduction occurred thirteen years ago. Mr. and Mrs. L. Pierard of Lynn Valley, British Columbia, cleared two acres of forest land, built a house and had a large garden. Answering an advertisement they ordered a variety of young trees and shrubs from Eastern Canada. The roots were wrapped in damp moss, grass and leaves. In the course of time both banded and unbanded snails appeared. As the mollusks were thought to be indigenous to British Columbia no attention was paid to the snails until much damage had been done. The Pierard home is bordered on three sides with native flora—hemlock, cedar, fir and alder—into which zone the snails have not yet penetrated. When my visit was made in September, 1959, the snails were thickly assembled on the stalks of *Phlox drummondii* and a few on other plants. Some specimens were taken for examination. Mr. A. H. Clarke, Jr., of the National Museum of Canada states that all the specimens belong to *Cepaea nemoralis*, both banded and plain shell types, and that the species has not been previously recorded from Western Canada. Among the grass and leaves in the garden were a few *Haplotrema sportella* Gould and *Vespericola columbiana pilosa* Henderson.

Another alien mollusk in the same locality is the fresh-water *Radix auricularia* Linne. These snails are confined to private goldfish ponds in gardens and are not reported feral.

WALTER MACKAY DRAYCOT
1521 Draycot Road
Lynn Valley
North Vancouver, British Columbia
8 April 1960

Some Observations of Moose at Wood Bay and Bathurst Peninsula, N.W.T.

MOOSE (*Alces alces andersoni*) were commonly seen at the Anderson River delta (69°42′N 129°00′W) during the summers of 1958, 1959 and 1960. In 1960 a total of 11 moose were seen at the mouth of the Anderson River at Wood Bay; all were young bulls. The first ones appeared on June 4, two days before the ice went out of the river; the others were seen on the following dates: June 19 (one), June 22 (two), June 25 (one), June 28 (two), July 3 (four), July 13 (one).

Most came from up the river and proceeded to the mud flats of the outer delta where they often lay down in shallow pools, submerging to the neck, especially when the mosquitos were bad in late June and early July. Four moose were observed browsing on the scrub willow (*Salix* sp.) of the tundra. Eventually they moved north along the shores of Wood Bay, their tracks being seen at Nicholson Isthmus (69°50′N) and on the east side of the bay as far as the north side of the Mason River delta (70°N).

Eskimos who formerly lived in the Wood Bay area told me that they oc-

casionally saw moose near the north coast of Bathurst Peninsula (70°30′N 128° 00′W). This is about 108 miles north of the tree line in the Anderson River valley and 84 miles north of the tree line in the Horton River valley.

These are the northernmost records of moose I have been able to find for Canada, and the locations are about the same latitude as that for moose in the report of Rausch (Arctic 4:147-195, 1951), the mouth of the Colville River in Alaska.

During waterfowl survey flights in the area of central Bathurst Peninsula, Franklin Bay and Darnley Bay on July 27, 1960, I made the following additional observations: Mason River delta (69°55′N 128°20′W), two bulls; Langton Bay (69°30′N 125°20′W), one bull. Also, on September 1, 1960, I saw two bull moose south of Liverpool Bay near Kaglik Lake (69°30′N 129°40′W). Moose also have been reported as regularly occurring in the vicinity of Coppermine (67°49′N 115°05′W) by Peterson in *North American Moose* (University of Toronto, 1-280, 1955). Banfield (Arctic 4:112-121, 1951) reports slightings of numerous moose by R. H. Smith of the U.S. Fish and Wildlife Service between the head of Eskimo Lakes and Liverpool Bay. This apparently means the vicinity of the mouth of the Kugaluk River.

Rev. J. Ruyen, formerly stationed at the now-abandoned Stanton Mission on Wood Bay, told of seeing 15 moose at one time in the inner delta of the Anderson River in the early 1950's. Antlers found at recent Eskimo sites (about 150 years old to date) at Wood Bay indicate that moose were hunted by Eskimos, although all the older sites contain only caribou and seal bones.

MacFarlane (Proc. U.S. nat. Mus. 4 (1405): 673-764, 1905) reports that when Fort Anderson (68°43′N) was established in 1861 moose were often seen feeding along the banks of the river. He observed evidences of browsing in thickets along the Horton River at 69°N.

Natives who formerly lived in the Anderson River valley told me that moose move upstream in this river and in the Horton River in September and October, and winter along the timbered parts of the valley.

THOMAS W. BARRY

Canadian Wildlife Service
750 Federal Building
Edmonton, Alberta
6 February 1961

The Tailed Toad in Southeastern British Columbia

ON AUGUST 6, 1958, I captured a tailed toad, *Ascaphis truei* Stejneger, near the headwaters of Storm Creek, a tributary of the Flathead River, in extreme southeastern British Columbia. Although this species is known to occur in western Montana, there are no Canadian records east of Manning Park, 300 miles to the west (G. C. Carl, *The Amphibians of British Columbia*, Provincial Museum Handbook No. 2, 1950).

The toad was discovered when a portion of the bank composed of loose gravel and sand slid out from beneath an overhanging turf five feet above the stream. Although the toad was a female and lacked the distinctive 'tail,' its vertical pupils immediately separated it from the Pacific tree toad, *Hyla regilla* Baird & Girard, which it resembled in size.

The toad's sluggish behavior and refusal to swim when placed in the water, together with the fact that it had apparently been buried under the overhanging bank, led to conjecture as to whether or not it had already entered its hibernating quarters. If such was the case, it would indicate that the tailed toad's period of seasonal activity in this locality must be extremely short. The elevation is approximately 5800 feet above sea level and there had been sharp frosts on the two nights preceding my observation.

JAMES GRANT

R.R. 2, Vernon, B.C.
6 March 1961

Gray Squirrel at Blue Sea Lake, Quebec

ON AUGUST 7, 1960, a mature male black squirrel (the black phase of the gray squirrel, *Sciurus carolinensis*) swam from Ellard Island to Big Island in Blue Sea Lake, near Messines, Quebec, a distance of about a quarter of a mile. At the end of the swim the animal climbed up a two-inch water pipe at the laboratory. I caught it and held it for a short time until it had recovered strength. I then set it free on a nearby island where there is lots of food. As far as I know, the gray squirrel is not abundant this far north in the Gatineau valley, and for this reason I wish to record its incidental occurrence.

FRED H. GLENNY

Blue Sea Lake Biological Laboratory
Box 102
Messines, Quebec
9 August 1960

The Central Newt in Thunder Bay and Rainy River Districts, Ontario

THE NEWT, including its four races, occurs in eastern North America from Florida to Quebec in the east, and from Texas to Minnesota and northern Ontario in the west. Breckenridge, in his *Reptiles and Amphibians of Minnesota* (University of Minnesota Press, 1944, p. 44), stated that the central newt (*Diemictylus viridescens louisianensis*) "is apparently widespread in the wooded parts of Minnesota." He had specimens from five counties including St. Louis and Cook, which lie immediately south of the districts of Rainy River and Thunder Bay, Ontario. Bleakney, in his "A Zoogeographical Study of the Amphibians and Reptiles of eastern Canada" (Bull. nat. Mus. Canada 155: 80, 1958), indicated on his distributional map that the race *viridescens* occurred across northern Ontario as far as Thunder Bay District. Logier and Toner in their "Check-list of the Amphibians and Reptiles of Canada and Alaska" (Contr. Roy. Ont. Mus. Zool. Palaeont. 41:13, 1955) recorded specimens from St. Ignace Island and from Lake Nipigon in Thunder Bay District.

I have intensively studied the fauna of the southern portion of Thunder Bay since 1938. In 1950 I recorded our observations on the local amphibians (Can. Field Nat. 64:93, 1950). These included records of newts from Nishin Lake, 35 miles southeast of Nipigon. They were found in the lake and in the stomach contents of brook trout (*Salvelinus fontinalis*) on May 1, 1941, when snow was still knee-deep along the shore. A newt taken in this lake by William Anderson on June 22, 1949, was also listed in the above notes. Subsequently this specimen was assigned to the race *viridescens* by E. B. S. Logier of the Royal Ontario Museum.

Despite diligent searching, I have found newts from only four additional localities in the decade following the above report. Three records were from Thunder Bay District: MacTavish Township, 30 miles east of Port Arthur, July 11, 1950, M. Farrow; Polly Lake, Hardwick Township, 60 miles southwest of Fort William, September 1, 1951, D. E. and A. E. Allin; Hazelwood Lake, Gorham Township, 25 miles north of Port Arthur, June 21, 1952, M. Farrow. The fourth record was from the District of Rainy River. This was a specimen collected in a small lake near Atikokan on May 20, 1953, by William Leishman.

All specimens, except the one from MacTavish Township, have been examined by Mr. Logier who assigned them to the race *louisianensis*. This was anticipated, since it is the form present in the adjacent counties of Minnesota as we have noted above. These records extend the Canadian range of the newt from Lake Nipigon west to Atikokan, approximately 160 miles. They close the gap between the presently described ranges of the race *viridescens* in northern Ontario and the race *louisianensis* in

northeastern Minnesota. The form *Diemictylus viridescens louisianensis* is an addition to the amphibian fauna of Canada.

It is likely that our local area is a region of intergradation between the races *viridescens* and *louisianensis*. The large series from Lake Nipigon included a few individuals which lacked red dots and in general they were small. The newt from Nishin Lake was larger than typical specimens of *louisianensis* but lacked red dots. One of the Polly Lake specimens had five black-bordered red spots on the dorsolateral region. Newts from Minnesota generally show some small red dots sometimes narrowly bordered with black. A large series of newts collected around Lake Superior would contribute to our knowledge of the areas of intergradation between the central and the red-spotted newts.

A. E. ALLIN, M.D.
Box 337
Fort William, Ontario
15 August 1960

A Case of Coyote Molesting Man

IN THE NIGHT of July 2-3, 1960, an unsual incident of coyotes, *Canis latrans* Say, molesting man, took place in Manning Provincial Park, British Columbia.

Thirty-six Boy Scouts and three adults were camped at 6500 feet in subalpine meadows. They lay on the ground in sleeping bags, some in tents, some under canvas flies, some in the open, scattered over about half an acre.

At 2.30 a.m. a boy was awakened by a coyote tugging at and biting his sleeping bag. Frightened shouts drove off the animal and awakened companions nearby. No clear account is possible of events taking place in the confusion of the next 15 minutes, but in that period 12 sleeping bags or their plastic coverings were pulled or bitten leaving tears or toothmarks. In nine cases boys were bitten through the sleeping bags on their legs or feet. In only three cases did bites break the skin. No person was molested while awake and moving, so it appears that sleeping bags, not boys, were the objects attracting the coyote. The animal was seen clearly in the light of a flashlight, and was driven off with rocks. It ran off some 25 yards, stopped, and after further chase retreated much farther, sat, and howled.

An inspection of the camp revealed that much of the food supply had been disturbed. Parcels and bags were broken open and dragged about, but little food had been eaten. Five ropes on a canvas fly had been cut. The animal had shown little fear of humans, and only one coyote seemed to be involved.

The camp settled down to sleep again, this time in a more compact group. At 5.00 a.m. a boy awoke to find a coyote within five feet of him. The camp was aroused again. One leader, making squeaking noises, brought this animal to within 10 feet of him, and it was photographed. This second animal was in poorer physical condition than the first, which was described as a healthy looking animal with coat in beautiful condition.

Later, two coyotes were heard howling, and then two were seen together on the snow of a nearby ridge.

Later that day medical authorities in Vancouver examined the three boys most severely nipped, and elected not to give rabies treatment. A major consideration was the apparent absence of rabies in British Columbia.

A good color photograph of the second animal leaves no doubt that it was a coyote. Possibly significant is the observation that for a period including the time of this incident, two coyotes in the habit of visiting a kitchen door at park headquarters were not seen about headquarters. These animals had lost some of their fear of man. The boys' camp was 2500 feet above, and 3 miles airline from, the kitchen at headquarters.

There has been much written about the intelligence, playfulness and peculiar behavior of the coyote. J. F. Dobie (The

Voice of the Coyote, 1949) has noted several cases of coyotes disturbing campers or their belongings (p. 108 and 194). However, no incident comparable to that described here could be found in the literature.

J. EDWARD UNDERHILL
Parks Branch
Department of Recreation and Conservation
Victoria, British Columbia
14 September 1960

An Ontario Record for the Small Round-leaved Orchis Variety *lineata*

WHEN this new variety of *Orchis rotundifolia* Banks was first described by Henry Mousley in the Canadian Field-Naturalist (55:64-65, 1941), only a single station was known. Mr. W. C. McCalla of Calgary, Alberta, first found it in damp mossy woods above Elkwater Lake, Cypress Hills, Alberta, on July 27, 1932. Five specimens were presented to the National Herbarium at Ottawa (McCalla No. 3843a) and Mr. Mousley's description of the new variety was based on this collection. The new variety differed from typical *Orchis rotundifolia* by having the lip not spotted but lined with two broad purplish stripes.

The type locality in the Cypress Hills of Alberta apparently remained the only known station for this plant until June 20, 1959, when the writer, his wife and Gilbert Dunham found it growing in a sphagnum bog in Palmerston Township, Frontenac County, Ontario. By an odd coincidence, a second Ontario location for this variety was discovered about a month later in July 1959, in Sibley Provincial Park by Mr. H. Vincent Elliott (Bull. Fed. Ont. Nat., No. 88, p. 18-20, 1960).

The Frontenac County plants were growing in a rather open black spruce–tamarack–sphagnum bog. Many plants of the regular spotted type of *Orchis rotundifolia* were in evidence. Scattered amongst them were occasional plants having on the lip wide, purple bands instead of the usual purplish spots. Specimen material and a colored photograph have been examined by Dr. James H. Soper of the Department of Botany, University of Toronto, who confirmed the identification. This Ontario occurrence establishes a considerable eastward extension of range for this unusual variety.

Also growing in this bog were the Large Yellow Lady's-slipper, *Cypripedium calceolus* var. *pubescens*, Showy Lady's-slipper, *Cypripedium reginae*, and Tall Leafy Green Orchis, *Habenaria hyperborea*.

OTTO E. DEVITT
83 Harding Boulevard
Richmond Hill, Ontario
30 September 1960

A Probable First-record Nesting of the Common Raven in the Ottawa District

ON MARCH 15, 1960, Max Forsyth and I saw a large black bird flying across the massive face of a high granite cliff on the north side of the Mountain Road, about ten miles northwest of Ottawa in Quebec province. (All observations in this report were made from the Mountain Road, which is separated from the base of the cliff by a swampy woods about two hundred yards wide.) Binoculars enabled us to determine that the bird was a Raven, *Corvus corax*, and, moreover, that it was carrying a large twig. It took the twig into a hole near the top of the cliff. The Raven soon appeared again and was promptly joined in flight by a second Raven; then both birds disappeared from our view.

On April 1, Hoyes Lloyd and I observed, momentarily, a large black bird perched on a bare tree at the top of the cliff but were unable to confirm its identity. On April 6, Mrs. Frith and I were watching a large black bird on the same bare tree. It launched into flight and was joined by a similar bird. Identity was confirmed when these two birds, in tandem, went through a series of magnificent

wheeling flight maneuvers then rose high above the cliff to pursue a soaring hawk. The hawk quickly went into a long, fast glide southward over our heads onto the plain of the Ottawa Valley. The Ravens pursued only a moderate distance then returned to the cliff face where they performed as before and uttered occasional guttural calls. Eventually both birds disappeared over the escarpment. On April 8, Hoyes Lloyd and I were at the site during a snow shower and saw no Ravens. On April 15, Hoyes Lloyd and I, while approaching the area, heard Raven calls and then saw a Raven circle and enter the same hole in the cliff. Raven calls continued to come from the lower region of the cliff, which was screened from our view. Soon the Raven left the cavity and was joined in flight by another Raven. Together they gave a spectacular display lasting several minutes. Then one bird entered the cavity and the other vanished.

On May 13 and 18, I returned for short periods but did not see or hear Ravens.

On May 23, Allan Bland and I heard unmistakable, low, varied, Raven utterances coming from the trees at the base of the cliff. The Ravens seemed elusive and we had glimpses only of very short flights across the lower portion of the cliff. After several minutes of low croakings the birds became silent. On this occasion no approach to the nest cavity was observed and we began to suspect that if young had been reared they had left the nest and were in the area below.

On May 28, Mrs. Frith and I observed a pair of soaring Ravens over the summit. In one instance a third bird of similar size joined the pair and almost immediately disappeared over the sky line. Later the same day, Dr. and Mrs. D. A. Smith and Dr. and Mrs. G. A. Hanes visited the area and saw a pair of soaring Ravens. On June 6, Earl Godfrey and I spent several fruitless hours in the region.

On September 27, on the new Gatineau Park Driveway about a mile west of Pink's Lake I saw a Raven pick up a small object from the pavement and with characteristic launching steps or hops fly into the woods. This area is about two miles from the probable nesting site.

Long ago the Raven was considered common near Ottawa. There are two local specimens in Ottawa Collections, which I have seen. One Raven, in the collection of Hoyes Lloyd, was taken by Basil Humphreys on November 17, 1935, at Battle Lake, Quebec, twenty miles northeast of Ottawa. The other Raven is in the collection of A. E. Bourguignon, and was taken on October 23, 1939, at Wendover, Ontario, thirty miles east of Ottawa.

ROWLEY FRITH

65 Acacia Avenue
Ottawa 2, Ontario
1 December 1960

Green Heron in Southwestern British Columbia

IN RECENT years there have been several sight records of the Green Heron, *Butorides virescens*, in southwestern British Columbia. Some of them have been published in the Murrelet and the Bulletin of the Vancouver Natural History Society; others have not been published. All of these records are given below.

On October 1 and 17, 1953, Alvin N. Wells observed one near Chilliwack (Murrelet 35:50, 1954). As far as I can ascertain, this is the first sight record for this species in British Columbia.

On August 24, 1958, Mr. Edward Moodie told me that he and Mr. Ross Anderson had observed a Green Heron in a ditch on Sea Island. I was unable to go out and see it. However, the next day, August 25, Mr. Allister Muir confirmed this sighting.

On May 24, 1959, Mrs. Marie Houlden and her husband observed one at Kawkawa Lake, east of Hope, B.C.

Mr. Allen Best of Stanley Park Zoo informs me he has two unpublished sight records in Stanley Park, one at Lost Lagoon for the late summer of 1959 and another at the duck pond late in 1960.

Unfortunately he has not recorded the exact dates.

Miss Gwen Wright, on June 5, 1960, observed one on Barnston Island in a marshy pond and boggy area. Barnston Island is in the Fraser River near the south side and west of Fort Langley.

September 2, 1960, Miss Doris Nye observed one at the head of the road dyke at the south end of Pitt Lake. This sighting was substantiated on September 3, 1960, by Mr. Jack Sarles, Miss Betty Wise, and Mr. Norman Precious.

As far as I can ascertain, there are no specimen records for British Columbia. There are specimen and nesting records for the State of Washington, the nearest being that of Mr. C. H. Channing of Clear Lake, Washington State. This location is about 90 miles south of Vancouver.

WILLIAM M. HUGHES

8755 S.W. Marine Drive
Vancouver 14, British Columbia
March 23, 1961

First Alberta Record for the Glaucous-winged Gull

IN JULY 1959 I banded a nestling Glaucous-winged Gull, *Larus glaucescens*, at a colony on the British Columbia coast, and this bird was recovered in Alberta some nine months later. Such inland strays are unusual for this species, but by no means unknown. Mrs. Z. M. Schultz, who maintains a complete recovery file, has informed me (in a letter) of several such occurrences. Dr. W. Ray Salt of the University of Alberta wrote me that my bird furnished the first Alberta record, and as I have received many inquiries I believe the facts should be recorded before rumor has obscured the case.

Number 597-56837 was one of 40 nestlings I banded on Christie Islet, south of Anvil Island, Howe Sound, B.C. (49° 30′ N 123° 18′ W), on 19 July 1959. Some 300 pairs of Glaucous-winged Gulls nest there, and also a few Pelagic Cormorants (*Phalacrocorax pelagicus*) and Pigeon Guillemots (*Cepphus columba*). The Glaucous-winged Gull is the only species of gull known to nest there, or, indeed, at any salt-water locality in the province. Nesting by the Western Gull (*Larus occidentalis*) has been suggested for the southwest coast of Vancouver Island (Pearse, 1946, Murrelet 27: 39-40) but this does not apply to Christie Islet, an inner-coast locality near Vancouver (for distribution see Drent and Guiguet, Occ. Pap. B.C. prov. Mus. 12, in press).

The bird was recovered alive on 15 April 1960, near St. Paul, Alberta (approximately 54° 0′ N 111° 15′ W), and was reported by Mr. G. W. Steedsman, Fish and Game Officer there, who has kindly furnished the following details: "This gull was brought to my office by some young boys who had found it along the shore of Therien Lake . . . immediately adjacent to the town of St. Paul. This bird had apparently been shot in the wing and was unable to fly, but was unhurt otherwise. I kept the bird for a few days and then returned it to the lake as it seemed to be making recovery. The band was left on the bird. I have no doubt as to the band number being correct as I took the number personally and was careful to recheck it." Mr. Steedsman, who was not expecting a stray, reported the bird to the banding office as an immature Ring-billed Gull (*Larus delawarensis*). Upon later enquiry, however, he informed me that the bird lacked the distinct tail band characteristic of that species.

Furthermore, the "Glossary of Banding Terms" (C.W.S. Bulletin to Banders) gives the recommended band size for the Ring-billed Gull as No. 5. The band in question is a No. 7, as indicated by the prefix 597. The facts have been given; whether they suffice to place *Larus glaucescens* on the Alberta list is not for me to decide. I wish to thank Mr. Steedsman for his alertness in reporting the record to the authorities.

WILLIAM J. MERILEES

1836 West 62nd Avenue
Vancouver 14, British Columbia
28 February 1961

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THE MAMMALS OF MANITOBA

J. Dewey Soper
7115 81st Street, Edmonton, Alberta

Illustrated by the author

Introduction

An up-to-date summary of the mammals of Manitoba has long been needed. Widely scattered publication of new and interesting facts makes it increasingly difficult to gain a clear comprehension of the provincial situation and to keep abreast of developments. What, for instance, is presently known about the different kinds of native species and subspecies to be found in Manitoba? What is their status and distribution? Have recent advances been made as to newly detected races and where they are found? Have interesting, extralimital occurrences been added to the list of Manitoba mammals?

Answers to these and other questions are desirable. Equally desirable, in a single paper, is a brief consolidation of both older and very recent records that are vital to an understanding of specific occurrences and provincial range. The presentation of such a review is the aim of this paper.

In 1927 I made a study of mammals along the International Boundary, in the Prairie Provinces, for the National Museum of Canada (Soper, 1946). Eventually further work in Manitoba became possible from 1934 to 1948 while I was with the Canadian Wildlife Service and had headquarters at the Winnipeg office.

These 14 years provided opportunity for extensive field work in most parts of southern Manitoba. As a result I gained much information on the various races, their better indicated, but not conclusive, geographic ranges, over-all distribution and more recent status. Not least among the gratifying results was the addition of some species and newly discovered races to the list of species of Manitoba mammals.

In the following summary of species and races personal records are partially based upon the 710 mammals collected in Manitoba from 1927 to 1948. The number of trap-nights involved was approximately 14,000. All specimens are now deposited in the permanent collections of the National Museum of Canada and the Department of Zoology, University of Alberta, respectively. Except where otherwise mentioned, and credit given, most statements are based on personal field investigations, together with the related specimens.

This is the first separate and complete summary of Manitoba mammals since the publication of Seton's work in 1909 and it prompts interesting reflections concerning the progress of Manitoba mammalogy in the past 50 years. Seton was aware of only 59 forms of mammals in Manitoba a half-century ago.

Mailing date of this number: 29 December 1961

The present account contains 119 species and subspecies. Of these, one (*Sorex f. fumeus*) is hypothetical; two other varieties, only casually mentioned in the text, and which may eventually be found in southeastern Manitoba, are *Mustela e. cicognanii* and *Mustela l. spadix*.

In relation to the above review it should be noted, however, that the province of Seton's day extended north only to about the 53rd parallel of latitude. The delimiting boundary, therefore, automatically excluded about 17 species and subspecies of mammals then known to occur in that section of the District of Keewatin that now lies in Manitoba. After due recognition of this circumstance, nevertheless, since 1909 an additional 43 forms have been added to the provincial list.

Despite this advance, much field work is required before a good basic knowledge of Manitoba mammals is more or less achieved. The situation is replete with fresh and continuing opportunities and additions of new subspecies remain a possibility.

Scientific terminology and sequence of species follow Miller and Kellogg (1955); *Sorex vagrans soperi*, however, is the term of Findlay (1955). In the former work, vernacular names are not usually supplied. Accordingly, for uniformity, the common names used here are mostly those employed by Anderson (1946). Statements regarding geographic ranges, not revealed to me by personal field work, new material, or recent records of resident co-operators are based essentially on those given in the latter volume.

All measurements of small mammals are given in millimeters in the order of total length, tail vertebrae and hindfoot; figures in parentheses, often following average measurements and weights, represent the extremes in size of the various series collected. Weights, when available, are presented in grams for the smaller species and in pounds for the larger ones.

Acknowledgments

For results that grew out of the investigations I owe a great deal to the facilities and opportunities routinely provided by the Canadian Wildlife Service. I am also greatly indebted to the late Dr. R. M. Anderson (National Museum of Canada) for the subspecific determination of all mammals collected in Manitoba. This place also provides a pleasant opportunity for acknowledging kind assistance received on many occasions from the staff of Riding Mountain National Park; Mr. G. W. Malaher, Director, Manitoba Game Branch; Messrs. L. T. S. Norris-Elye and Richard Sutton, past and present directors of the Manitoba Museum; Mr. Stuart Criddle, formerly of Treesbank; and Messrs. A. Hochbaum, R. Ward and Lyle Sowls, Delta Research Station, Lake Manitoba.

Earlier Investigations

The earliest scientific work on Manitoba mammals is now shrouded in a dim and distant past. Just who, among Caucasians, made the first observations and written records is uncertain. Historically, at least, it is interesting to note that the first white men to see Red River, in southern Manitoba, were Pierre Gaultier de Varennes La Vérendrye and his sons, about 1732. Apparently little of zoological value developed from these explorations.

The earliest important work on the Hudson Bay region is Edward's *Natural History*, published in four volumes from 1743 to 1751. Between 1751 and 1772 various officers of the Hudson's Bay Company (Light, Isham, Graham, Hutchins and Hearne) contributed extensively by means of memoranda, published accounts and collections of specimens.

Results of a highly significant character grew out of the inquiries of Dr. John Richardson (1829) and Thomas Drummond early in the last century. At that time Richardson was attached to the first two Franklin Polar Expeditions – Drummond on the second – between 1819 and 1827. On these occasions their inland route from and to York Factory, Hudson Bay, cut across what is now northern and central Manitoba by way of Nelson River, Norway House, Cedar Lake and Saskatchewan River.

Robert Bell reported on mammals in the country west of Lake Manitoba and Lake Winnipegosis, in 1876, and six years later John Macoun published his *Manitoba and the Great Northwest*, in which he devoted 28 pages to notes on mammals. Miller Christy followed in 1885 with a short paper, *Notes on Mammals of Manitoba.*

In 1886, Ernest E. Thompson [Seton] published a comprehensive list of Manitoba mammals, as then known, before which time he had lived at Carberry. Next was his pamphlet *Fauna of Manitoba* (1909). This was succeeded in the same year by a much more elaborate treatment in two volumes (essentially based on Manitoba mammals) entitled *Life Histories of Northern Animals* (1909a); next was a notable work in four volumes, *Lives of Game Animals* (1925-1928), also containing Manitoba data.

During the summer of 1900, Preble (1902) collected in the region from Norway House by way of Oxford and Knee lakes and Hayes River to York Factory, thence north along the coast to Churchill and the vicinity of Eskimo Point. It would be difficult to overestimate the importance of Preble's investigations in this region – not only with respect to the consolidation and verification of old records, but the great amount of original work achieved in relation to the fauna in general. His book is still indispensable for information on the vast hinterland between Lake Winnipeg and Hudson Bay.

Since Seton's time various observers have contributed, in greater or lesser degree, to a knowledge of Manitoba mammals. Especially to be singled out is that veteran naturalist, Mr. Stuart Criddle (1915 and other years), who has so liberally enriched the literature with wildlife articles; his observations have been made over a period of about 50 years, chiefly in the Treesbank–Spruce Woods Forest district. Others to be briefly mentioned are Bird (1927, 1930); Green (1932); Jackson (1934); Shelford and Twomey (1941, 1943); Sowls (1948); Manning (1948); Banfield (1949, 1954); Quay (1955); and Smith and Foster (1957).

Deserving of special mention is Anderson's unique and scholarly *Catalogue of Canadian Recent Mammals* (1946), which contains important information on Manitoba species. In it he has dealt with historical classification, the latest nomenclature, new Canadian races, specific and subspecific ranges, and other matters, relating to the whole of Canada.

PHYSICAL GEOGRAPHY

Up to 1912, Manitoba had an almost square shape, with all sides approximating 290 miles in length; the northern boundary lay in about latitude 50°. In the year mentioned, however, it was extended north to the 60th parallel and eastwards to Hudson Bay. Thus Manitoba acquired a seacoast. What is now northern Manitoba was formerly situated in the District of Keewatin, Northwest Territories. Consequently, the earlier published records of such men as Franklin, Richardson, Preble, and others, associated with the latter territory south of the 60th parallel, now properly belong to the Province of Manitoba.

Topography of the province is highly diversified. From points about 40 miles east of Red River, the first prairie steppe stretches west to Pembina Hills and northwards to include the lowlands west of Lake Winnipeg that spread to the skirts of Riding, Duck and Porcupine mountains. Most of this nearly flat terrain was once covered by the ancient post-glacial Lake Agassiz. The elevation of this practically featureless lowland varies between 720 and 1300 feet above sea level, but averages about 900 feet.

Immediately to the west is the second prairie steppe, which rises several hundred feet above the Red River Plains. It begins at the conspicuous Pembina Hills escarpment and sweeps west to southeastern Saskatchewan; mean altitude is about 1,750 feet. Much of the surface is rather uniformly flat, or gently rolling, but some parts are more undulating, or distinctly hilly. Outstanding features include Pembina, Tiger and Brandon hills.

In this region Turtle Mountain is particularly prominent. It rises to a maximum elevation of 2,500 feet, or some 600 feet above the surrounding plains. Principal bodies of water on the second steppe are Rock, Pelican, Whitewater and Oak lakes. The ancient Lake Souris covered a wide expanse in the southwestern corner of the province, the prairie floor of which is now called the Souris Plains.

The southeastern extremity of Manitoba and northwards, east of Lake Winnipeg, is of rugged character in marked contrast with the topography of south and south-central areas; here the leading features are hills, rocky ridges, innumerable lakes and clear, fast-flowing streams. This is notably true of the land lying north of latitude 53 or 54 degrees.

The abundance of small lakes is especially remarkable in the region between Lake Winnipeg and Hudson Bay and in the entire northwestern part of the province from latitude 54° north to the District of Keewatin. The whole of northern Manitoba is characterized by this type of topography; in addition there is a profusion of glacial moraines, sand eskers, bogs and muskegs. A strip of true Arctic tundra flanks the entire Manitoba coast at Hudson Bay, becoming increasingly wider to the north.

In the extreme west-central part of the province, immediately north of the parklands, three high erosion plateaus lend marked effect to the scenery. These are Riding, Duck and Porcupine mountains; their altitudes approximate 2,000 feet above sea level. Directly to the east and north they are bounded by vast lowlands cradling a bewildering array of shallow ponds, lakes, marshes

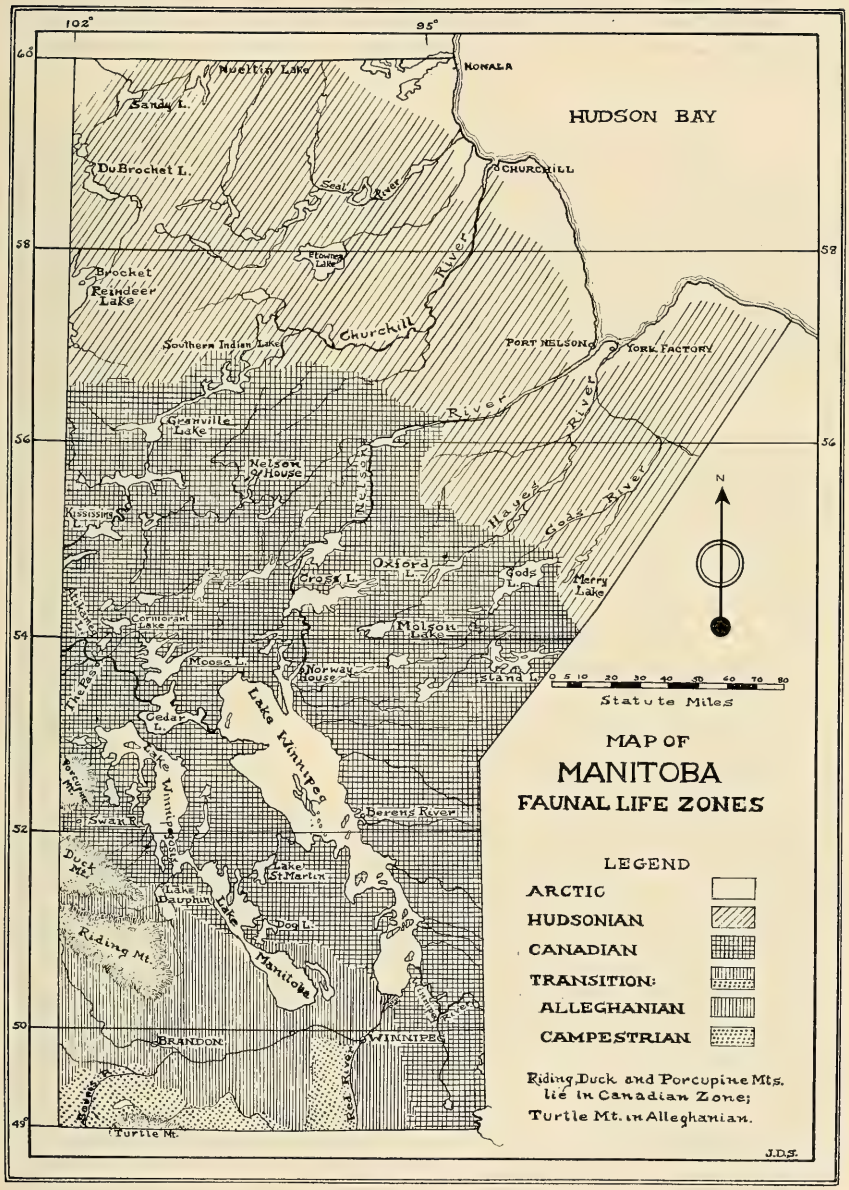

FIGURE 1. Outline map of Manitoba showing the faunal life zones of the province.

and streams. In this same depression lie the great lakes of south-central Manitoba – Winnipeg (713 feet); Manitoba (814 feet); Winnipegosis (831 feet); and Dauphin (854 feet) – the largest existing in the whole prairie belt of the West. Primary drainage of all this region is by way of Nelson River to Hudson Bay.

FAUNAL LIFE ZONES

An understanding of faunal life zones is essential to a ready comprehension of animal distribution and other matters. Mammals, for example, are controlled in their horizontal and vertical dissemination by ingrained preferences for certain types of environment; this holds true not only for major zones, but commonly for the local type of habitat within these zones. Specifically, they rarely stray far from the respective ecological niches for which they have been fitted; this adherence is imposed by such factors as temperature, heredity and adaptation.

There exist in Manitoba five distinct, major types of environment. These superior kinds of flora–climate areas are categorized by zoologists as life zones. In the present instance the Merriam system of classification has been employed, adapted from Anderson (1946). From south to north these zones are called, respectively, Transition (subdivided into Campestrian and Alleghanian subfaunas), Canadian, Hudsonian and Arctic life zones (*see* zonal map, Figure 1). Some species are confined to a single zone; others of greater adaptability are found in two, or more. When a species ranges through several zones, or subfaunal areas, it is more or less commonly represented in each by a recognizable geographical race.

A brief analysis of the Manitoban life zones follows.

Transition Life Zone. All of southern Manitoba south and west of the lower limits of the mixed-wood (Canadian Zone) forest falls within this zone. It is characterized by two distinct environments:

(a) *Campestrian Subfaunal Division.* As the name implies, this area embraces the entire section that was originally true, primitive prairie (Figure 2). In Manitoba it represents the absolute northern limits of the treeless Great Plains. A broad tongue extends north between Red River and the second prairie steppe to about the latitude of Winnipeg. Except for a short break at Pembina Hills (and exclusive of Turtle Mountain), it covers a band of country of varying width (up to about 25 miles), north of the 49th parallel, from the vicinity of Red River Plains west to the Saskatchewan boundary. The area is progressively dryer to the west; at times semiarid conditions prevail in the southwestern corner of the province. Formerly this was typical range for the bison and antelope.

(b) *Alleghanian Subfaunal Division.* This is the territory usually referred to as the aspen grove belt or parklands (Figure 3). An extensive band occurs

FIGURE 2. Rolling grasslands near Souris River, south of Melita, characteristic of the Campestrian subdivision of the Transition Life Zone.

FIGURE 3. La Salle River, three miles west of Sanford; Alleghanian or parklands subdivision of the Transition Zone.

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on the first prairie steppe east of Red River and northwest to Lake Dauphin, but the greater expanse exists on the second steppe west of Pembina Hills escarpment. It is chiefly typified by woods of aspen or bur oak and a sturdy undergrowth of willows, alders and chokecherry; here and there this cover is interspersed with patches of prairie supporting low copses of such shrubs as snowberry and silverberry. There are also local stands of Manitoba maple, green ash and white elm.

It seems best to include Turtle Mountain in this subdivision, as there is a lack of conifers; however in some aspects of the mammalian fauna it is definitely somewhat more boreal in character than the Alleghanian parklands (*see* Bird, 1927, 1930).

Canadian Life Zone. This biotic area occupies the greater part of Manitoba. It is chiefly mixed-wood forest with bogs, muskegs and clear, cold lakes and streams (Figure 4). Vegetation is mostly black and white spruce, larch, Banksian pine, balsam fir, paper birch and aspen and balsam poplar. The southern margin of the zone runs approximately from Pine Valley (in the southeast) northwards past the southern end of Lake Winnipeg to about Dog and Dauphin lakes, thence along the eastern and southern flanks of Riding mountain; from here it crosses the Manitoba–Saskatchewan border in about latitude 51° 30′ N.

In some areas there are pseudoprairies that bear close resemblance to those in the parklands (Figure 5). An isolated outrider of the Canadian Zone is simulated in an area of spruce woods and larch bogs east of Brandon. From the southern perimeter of the mixed-wood cover, as outlined above, uninterrupted Canadian Zone forest blankets the whole width of the province north to about Gods Lake, Kettle Rapids and Southern Indian Lake (see map). Beyond are the stunted woods of the next zone.

Hudsonian Life Zone. Biologically and climatically, this biotic division is a transition between the heavily forested Canadian Zone on the south and the Arctic tundra to the north (Figure 6). It is chiefly typified by sparser and more stunted vegetation; cover consists mainly of the spruces, Banksian pine, larch, birch, aspen poplar and various shrubs. Size and frequency of barren tracts become increasingly greater to the north until they finally merge with true Arctic tundra. The transition from Canadian Zone to Hudsonian is very gradual; it is so subtle, indeed, as to make the dividing line, between the two, the most poorly defined of zonal limits. Of all the zones, the present one contains the lowest number of truly characteristic species.

Arctic Life Zone. This division is probably so well visualized by the general public that little description is needed. A dominant feature, of course, is the complete lack of trees (Figure 7). All vegetation is reduced to small size. Sterile rock and sand ridges often alternate with shallow ponds and lakes,

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FIGURE 4. Mixed-wood forest of the Canadian Zone along Red Deer River, near Dawson Bay, Lake Winnipegosis.

FIGURE 5. Pseudoprairie and parklands within the Canadian Zone of Riding Mountain National Park; about four miles north of Lake Audy.

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or boggy terrain garbed in various grasses and sedges. Much of the country is relatively flat, to gently rolling, and often strewn with boulders. It is commonly devoid of vegetation, except for mosses and lichens, and, at best, usually supports a sparse cover of polar grasses, small vascular plants and stunted willows and dwarf birch.

The summers are very short, but characterized by profuse daylight; the winters are long, severely cold, graced with few hours of light, or wrapped in continuing darkness. In the fight for survival, the animal life of this peculiar world has been obliged to develop special adaptations as to general habits and physical equipment. The most familiar mammals include polar bear, Arctic fox and hare, tundra wolf and the two species of lemmings.

ANNOTATED LIST

Order INSECTIVORA. Insect Eaters

CINEREOUS SHREW *Sorex cinereus cinereus* Kerr. Widely distributed and usually of fairly common occurrence in the northern coniferous forest; occasionally taken in bordering fringes of the parklands. More northern occurrences include Flin Flon (Rand, 1948); York Factory (Preble, 1902); Churchill (Quay, 1955; Smith and Foster, 1957); and Nueltin Lake (Harper, 1956). It is more abundant in some years than in others, periodically becoming at least locally scarce.

Cinereus was personally collected at Sandilands and Whiteshell Forest Reserves; Caliente; Marchand; Fort Garry; Riding Mountain; Little Salt Lake; Elm Point, Lake Manitoba; Mossy River; Duck Mountain; Dawson Bay, Lake Winnipegosis and Overflowing River. Average measurements of 30 specimens from the above localities: 99.2, 38.5, 11.9 (85, 29, 10.5—108, 45, 13) mm; weight 3.3 (2.9—4.2) grams. Long-time average rate of capture was one per 80 trap-nights, with a low of 1 in 400 and a high of 6 per 100 trap-nights.

HAYDEN CINEREOUS SHREW *Sorex cinereus haydeni* Baird. This race replaces *cinereus* over most of southwestern Manitoba south of the Canadian Zone. It chiefly inhabits parklands and brushy prairies; parts of its range verge upon semiarid conditions. Apparently *haydeni* has not yet been detected on the first prairie steppe, but there seems to be no reason for actual exclusion. It is moderately common at times on the second steppe, including Turtle Mountain. Collectively, 12 specimens were taken at Treesbank; William, Breaden and Max lakes, Turtle Mountain; and the junction of Antler and Souris rivers. Average measurements of these are: 97.3, 38.1, 11.5 (91, 32, 10.3—105, 40, 12) mm; weight 3.4 (2.6—4.2) grams.

SMOKY SHREW *Sorex fumeus fumeus* Miller. Hypothetical. A shrew thought to be this species was collected by Buckner (1957) near Rennie; it was lost, however, before critical examination could be made. Possibly to be looked for in the extreme southeast where it would rank as a very rare member of the fauna at the western extremity of its geographic range. The nearest authentic record to the east appears to be for Thunder Bay, Lake Superior.

AMERICAN SADDLE-BACKED SHREW *Sorex arcticus arcticus* Kerr. An insectivore of the Canadian Zone, habitually frequenting spruce-sphagnum bogs and swampy margins of lakes and streams. The Manitoba range is apparently from about latitude 55°30′ in the east (Swampy and Robinson lakes; Preble, 1902), to Riding Mountain and northward more or less throughout the boreal forest to the Northwest Territories. A total of 18 specimens was collected at Whitemouth Lake and River; Delta and Elm Point, Lake Manitoba; Lake Frances; and Riding and Duck Mountains; these average 113.7, 38.6, 13.9 (106, 29, 13—123, 46, 15.5) mm; 7.5 (5.7—8.8) grams. *Arcticus* is rarely com-

FIGURE 6. Hudsonian Zone, illustrating character of the vegetation about midway between Canadian and Arctic zones; north of Bird, Manitoba, Hudson Bay Railway.

FIGURE 7. Typical rock-strewn barren grounds characteristic of much of the Arctic coastal tundra north of Port Churchill, Manitoba; polar grasses and dwarf willow in the foreground.

mon; specimens are usually obtained slowly and sporadically.

SOUTHERN SADDLE-BACKED SHREW *Sorex arcticus laricorum* Jackson. From adjoining states, this form ranges into the southeastern part of the province and as far west as Turtle Mountain, Aweme (north of Treesbank), Carberry and Spruce Woods Forest Reserve. More information is desirable on its Manitoba distribution. Like *arcticus*, it appears to be local and far from common. My five specimens, derived from Marchand and Breaden and Max lakes, Turtle Mountain, average 117.4, 42, 14.2 (114, 40, 13—123, 44, 14.5) mm; 7.8 (7.1—8.7) grams. Habitat is essentially similar to that of *arcticus*, with which it shows signs of intergradation at Aweme and Carberry.

PLAINS DUSKY SHREW *Sorex vagrans soperi* (Anderson and Rand). Three specimens of this race were personally collected at Whitewater Creek, Riding Mountain (Canadian Zone), on September 20 and 21, 1940—the first record for Manitoba (Anderson and Rand, 1945). Previous to this find, the easternmost specimens in Canada came from Cypress Hills, Saskatchewan. The Manitoba records consequently extended the known range of *S. v. soperi* several hundred miles to the east. Another example was taken at Swanson Creek, Riding Mountain, on July 17, 1942. Average measurements and weight of the four specimens are 108, 44.2, 12.3 (100, 43, 12—117, 45, 12.5) mm; 6.2 (5.7—6.7) grams. The animals were resorting to scattered willow-alder thickets on moist ground near streams.

AMERICAN WATER SHREW *Sorex palustris palustris* Richardson. Sparingly distributed in Canadian Zone woods from southeast to north and northwest beyond the great lakes of the province, to at least the latitude of Churchill (Smith, 1957). It also occurs in isolated boreal 'islands' as far southwest as Spruce Woods Forest Reserve. The normal habitat comprises marshes, swampy grass-shrub margins of streams and lakes, and borders of streams in mixed-wood forest. The species seems never to be common; trapping usually suggests rarity. Ten specimens from Red Rock Lake; Delta, Lake Manitoba; and Riding Mountain (Clear and Whitewater lakes and Swanson and Kennice creeks) average: 151.7, 66.1, 19.5 (142, 61, 19—163, 70, 20.2) mm; 13.7 (12.3—14.7) grams.

AMERICAN PYGMY SHREW *Microsorex hoyi hoyi* (Baird). Always a prized collector's item because of its rarity. Surprisingly, however, it may at times become locally common (Criddle, 1932a). It occurs erratically in southern prairie-parklands, at least on the second prairie steppe. Stuart Criddle informed me that he had collected specimens at Aweme and South Junction; these are evidently the only well-authenticated records for Manitoba.

Seton (1909) refers to a pygmy shrew from Winnipeg—sub-specific identity unknown. However, any Manitoba *Microsorex* taken south of about latitude 50° is likely to be the present type form. Intergradation between *hoyi* and *intervectus* theoretically takes place in the general vicinity of a line running from about Winnipeg to the base of Riding Mountain. Apparently this race is, on the average, slightly smaller than the more northern *intervectus*.

NORTHERN PYGMY SHREW *Microsorex hoyi intervectus* Jackson. Little data is available on this race in Manitoba. It is thought to range across the province in the extreme upper Transition Zone and well into the Canadian. Limits of range are uncertain. In the east it probably occurs to about latitude 52°, there theoretically intergrading with *M. h. alnorum*. In the northwest it is found at least as far as the Flin Flon district (Rand, 1948).

Four specimens were taken, collectively, at Stony Mountain; Delta and Elm Points, Lake Manitoba; and Swanson Creek, Riding Mountain (Soper, 1952); these average 84.2, 30.2, 10.7 (82, 26, 10—86, 36, 12) mm; 3.15 (2.6—3.4) grams. The more southern examples, while approaching *hoyi*, are considered closer to *intervectus*.

ALDER PYGMY SHREW *Microsorex hoyi alnorum* (Preble). Ranges in northeastern Manitoba and extreme northwestern Ontario. This race was first collected in 1900 by Edward Preble (1902) at Robinson Portage (type locality) and the nearby Echimamish River. In Manitoba it is known only from this district. The original description of *alnorum* was based on only two specimens, one of which was badly damaged and almost worthless for study. Because of this, some doubt existed as to the validity of this race. Since 1900, however, a series of

40 *Microsorex* was taken in 1938 by the Royal Ontario Museum of Zoology expedition to Favourable Lake, Ontario, which lies about 120 miles southeast of the type locality; this material fully supports the naming of *M. h. alnorum* as a distinct and well-founded geographical race. It is said to average somewhat larger than *intervectus*.

MANITOBA SHORT-TAILED SHREW *Blarina brevicauda manitobensis* Anderson. A comparatively new subspecies, the type specimen of which was personally collected on October 29, 1927, at Max Lake, Turtle Mountain (Anderson, 1946; p. 23). It is distributed in both Transition and Canadian zones. West of Lake Winnipeg, at least, it ranges as far north as latitude 54° (Krivda, 1957). In some areas, such as Fort Garry, it may be quite common; in others, very scarce or absent (Soper, 1944a). It seems to prefer the vicinity of streams and swamps, but occasionally is found on dry, aspen–bur oak uplands.

Specimens were collected at Sandilands Reserve; Telford; Caddy Lake; Fort Garry; Spruce Woods Forest Reserve; Turtle Mountain; Rock, Dog and Frances lakes; Elm Point, Lake Manitoba; Riding and Duck mountains; Mossy River, Lake Dauphin; Overflowing River; and The Pas. A Lake Winnipegosis trapper stated that these shrews were abundant at Pickerel River, about 1940, and that he had accidentally caught several in steel traps set inside muskrat lodges, as well as at "push-ups." Average measurements and weight of 49 individuals from the above localities: 125.3, 25.7, 16.2 (117, 22, 15–135, 28.4, 17.2) mm; 20.9 (14.7–25.3) grams.

STAR-NOSED MOLE *Condylura cristata cristata cristata* (Linnaeus) (Figure 8). Confined to a comparatively small range in southeast, north to Winnipeg River and westward to Riding Mountain. Occurs in both Transition and Canadian zones. To be regarded as rather rare, as there are few authentic records, or existing specimens. Seton (1909) recorded it at Winnipeg; Harry Van Sickle, a trapper at Lake Jessie, stated that one was caught a few miles north of Whitemouth. Three examples from Manigotogan and one from Pine Falls were recorded by Jackson (1934). Of recent years specimens have been secured by the Manitoba Museum from Great Falls, Falcon Lake, Great Black River, Decimal and Rennie. The northwestern limit of its geographic range in Manitoba (Soper, 1952) appears to be the southeastern angle of Riding Mountain.

Order CHIROPTERA. Bats

LITTLE BROWN BAT *Myotis lucifugus lucifugus* (Le Conte). In suitable situations occurs throughout the southern part of the province and indefinitely to the north, where limits of range are not well known but probably extend almost to the Hudsonian Zone. Bats regarded as *lucifugus* have been seen repeatedly in the Flin Flon district (Rand, 1948). Small bats thought to be this species were noted at Fort Garry, Douglas Lake, Killarney, Birtle and Swan River. Oral reports of occurrences were recorded for Treesbank and Turtle Mountain. The Manitoba Museum has five specimens from Max Lake, Turtle Mountain, taken August 20, 1949; these came from a group of about 80 that had denned up in a shed.

TROUESSART MOUSE-EARED BAT *Myotis keenii septentrinonalis* (Trouessart). Not personally detected. Apparently the only Manitoba record was established by Criddle (1932a) with two specimens secured from J. R. McPherson of Souris in August 1932.

SILVER-HAIRED BAT *Lasionycteris noctivagans* (Le Conte). Generally distributed in Transition and Canadian zones. Fairly common in at least southern districts, diminishing farther north. Comparatively little is known about dispersal of the species in Manitoba.

BIG BROWN BAT *Eptesicus fuscus fuscus* (Beauvois). Very sparingly recorded for some southern localities. It ranges mostly farther south, but occurs in the aspen parklands north at least to lower fringe of the Canadian Zone. Much more information is needed regarding this and other species of bats in the province. Somewhere to the west, probably in eastern Saskatchewan, *fuscus* intergrades with the paler form *E. f. pallidus*.

NORTHERN RED BAT *Lasiurus borealis borealis* (Müller). As a summer visitant, not uncommon in the Alleghanian parklands and north sparingly in at least the lower fringes of the coniferous forest. Seton (1909) mentions it as a summer visitor in all the southwestern part of the province and Criddle (1929) records it as fairly common

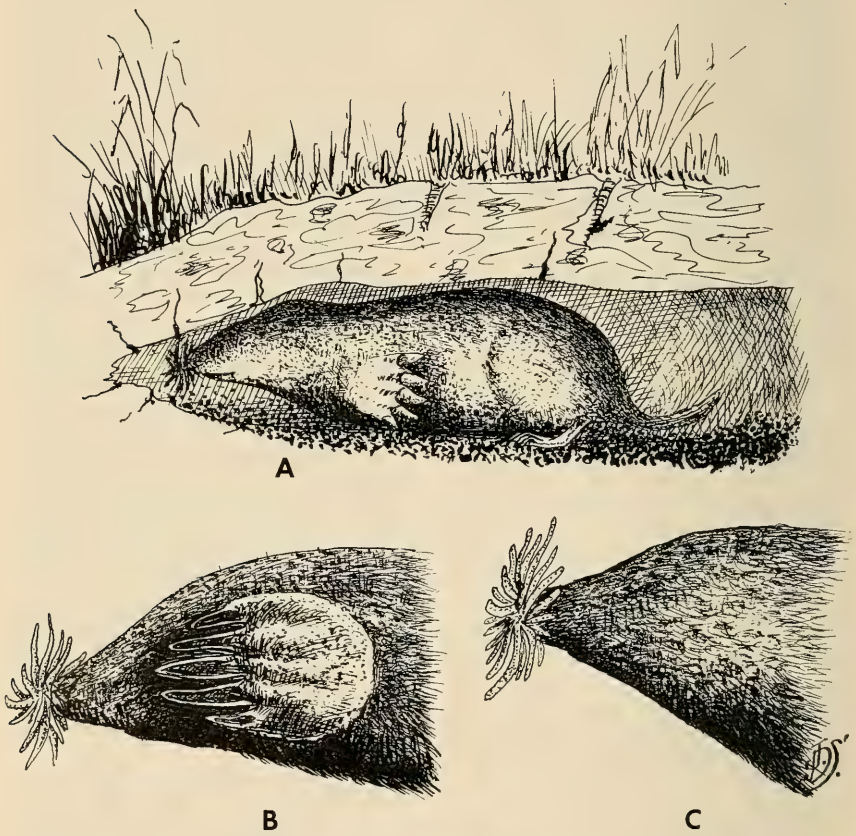

FIGURE 8. *A*, Star-nosed mole in underground feeding tunnel; *B*, the same, with left front foot in forward digging position; C, star-nosed mole, showing fleshy processes on nose which form the nasal disk.

at Aweme. Probably the commonest of the larger bats. On August 29, 1934, the writer secured one at Winnipeg; during the early morning it was found lying on the lawn in a stupor following a rather cold night; it had evidently fallen from a tree overhead. The specimen measures (mm) 115, 45, 10; height of ear 14; tragus 6.5.

HOARY BAT *Lasiurus cinereus cinereus* (Beauvois). Ranges in summer over all southern Manitoba and north, perhaps more or less regularly, to the lower part of the Hudsonian Zone. Said by Seton (1909) to be "somewhat common", and by Criddle (1929) as "tolerably common" at Aweme. Such may be the case locally, though on the whole it seems to be rather rarely encountered.

Order LAGOMORPHA. Hares and Rabbits

HUDSON BAY ARCTIC HARE *Lepus arcticus labradorius* Miller (Figures 9 and 10). Only a very limited number of these fine hares inhabit Manitoba, owing to a restricted area of suitable environment. Most are confined to the relatively narrow coastal strip of Arctic tundra lying between Churchill and the Northwest Territories. Up to a point, density of the breeding population increases with the latitude. Lesser numbers resort to the narrowing coastal tundra south of Churchill. Preble (1902) remarks that "In winter they migrate to a slight extent, reaching the neighborhood of York Factory and perhaps farther". Average measurements of this species are about 560, 60, 155 mm and a weight of between 6.5 and 7.0 pounds.

WHITE-TAILED JACK RABBIT *Lepus townsendii campanius* Hollister. In moderate numbers, inhabits nearly all of the prairie districts of the south as well as extensive areas of parklands to the north and east; in the latter direction it has been seen as far as Lake Jessie, Winnipeg River; Whitemouth; Ste. Anne and Marchand. Also occurs in the interlake district (Dog Lake and Oak Point, Lake Manitoba, and probably farther north) and, immediately west of Lake Manitoba north to at least Dauphin Lake. On the west side of the province *campanius* reaches a higher latitude than elsewhere, ranging at least to Riding Mountain and Gilbert Plains. A male taken at Delta measures 604, 84, 156, ear 126 mm and weighed 7.75 pounds.

AMERICAN VARYING HARE *Lepus americanus americanus* Erxleben. Occupies the whole province except the extreme southern portion (but including Turtle Mountain), north to Hudson Bay and the Northwest Territories. It is normally common, to abundant, during the periodic cyclic peaks, then very scarce for a few years following crash declines. Four specimens collected at Turtle and Riding mountains, Dauphin and Overflowing River, have average measurements of 433.3, 40.7, 127.2 (390, 30, 105—505, 48, 145) mm; 3.25 (2.25—4.25) pounds. Some individuals in the northern sections of the parklands show an approach to the following subspecies

FIGURE 9. Hudson Bay arctic hare in winter coat.

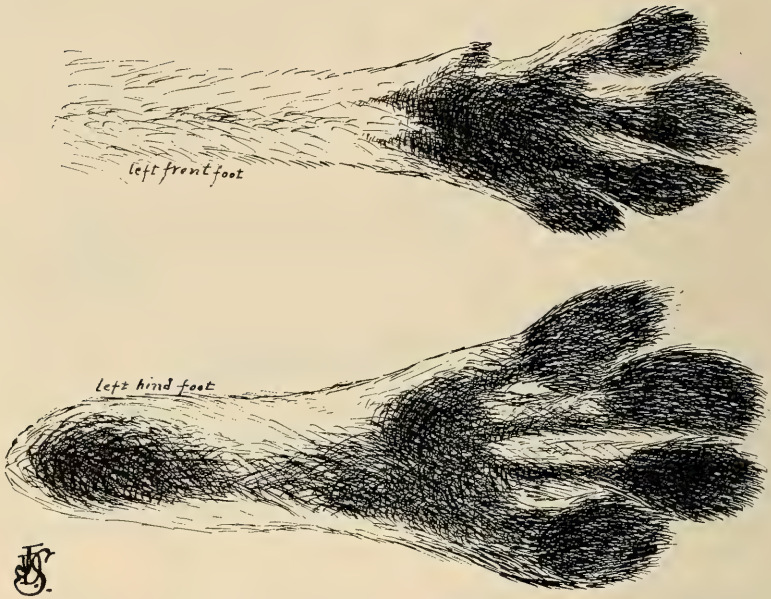

FIGURE 10. Left front and hind foot of the Hudson Bay arctic hare.

MINNESOTA VARYING HARE *Lepus americanus phaeonotus* Allen. Manitoba distribution is not clearly defined. However, *phaeonotus* appears to range in suitable situations on the first and second prairie steppes (west of Red River) for a distance of 90 to 100 miles north of the International Boundary; northward distribution east of Red River seems to be of lesser extent. Five specimens assigned to this race were collected at Marchand, Rock Lake, and forks of Antler and Souris rivers, respectively; these average 399.4, 29.2, 113 (370, 25, 105—432, 36, 127) mm; 2.56 (2.1—4.0) pounds. Other points of known occurrence are Lake of the Woods, Selkirk, Shoal Lake, Fort Garry, Carberry and Aweme. As with *americanus*, great fluctuations in numbers develop; they were locally common, to abundant, in 1942-1943 and apparently declined in 1944. Criddle (1938) gives previous peak years as 1922-23 and 1933-34; his paper contains a wealth of information on *phaeonotus* in the Treesbank district.

NEBRASKA COTTONTAIL *Sylvilagus floridanus similis* Nelson (Figure 11). A comparatively recent newcomer to Manitoba, in modern times at least. Not mentioned by Seton (1886; 1909a). Evidently reached the International Boundary in the Pembina-Emerson area in 1912. Criddle (1929) collected the first Canadian specimen three miles north of Treesbank on February 11, 1914. In 1927 it was reported to me as having appeared only a short time before near the forks of Antler and Souris rivers. It evidently did not reach Lorette until 1942 and by 1946 had become moderately common in the woods along Seine River.

The animals are now more or less familiar residents of Red River Valley north to at least Lake Winnipeg and northwest to Stonewall; common at Morden, Carman and Pembina Hills; known to ocur in some numbers along Pembina, Assiniboine, Antler and Souris Rivers and on Turtle Mountain. Anderson (1940) reported cottontails as far north as Dauphin. For a small mammal, the

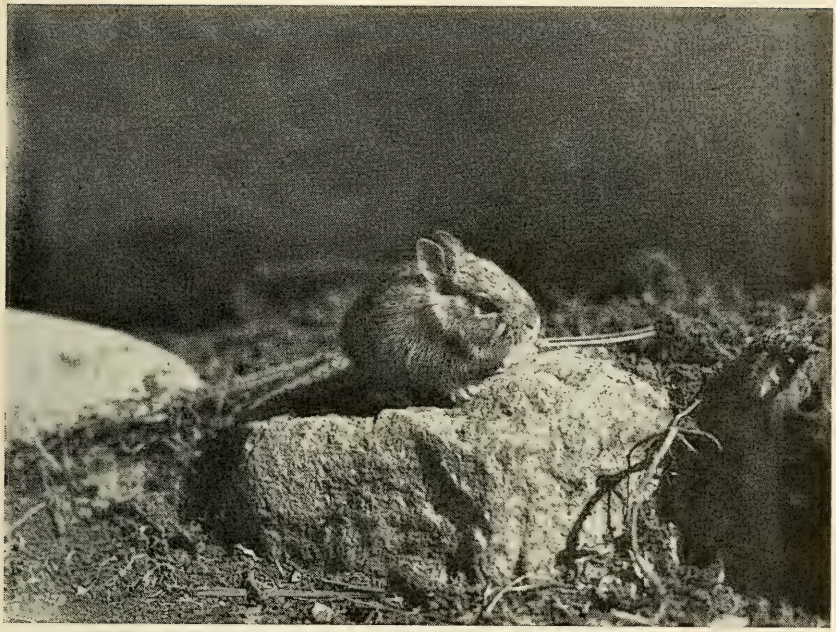

FIGURE 11. Young cottontail rabbit in late spring.

northward spread of *similus* has been accomplished with astonishing rapidity. A male personally collected near Winnipeg in November, 1943, measured 425, 46, 98 mm and weighed 2.25 pounds, and a juvenile at Fort Garry on May 6, 1948: 140, 17, 35 mm; 48.7 grams.

Order RODENTIA. Rodents

CANADA WOODCHUCK *Marmota monax canadensis* (Erxleben). Apparently inhabits the whole of Manitoba where there is a cover of trees and brush, north at least to York Factory and South Indian and Reindeer lakes. While not uncommon in parts of the aspen grove belt, it seems to reach a height of abundance in southern areas of the Canadian Zone. The animals are numerous from Whitemouth Lake north through Whiteshell Forest Reserve and well represented on Riding, Duck and Porcupine mountains. However, they are less numerous in north-central areas than farther south. During the summer of 1940 I noticed more woodchucks across the Prairie Provinces than ever before. Average measurements of three individuals (two melanistic) taken at Lake Jessie, Winnipeg River, are 525, 130, 74 mm; 5.8 (4.9—6.5) pounds.

RICHARDSON GROUND SQUIRREL *Citellus richardsonii richardsonii* (Sabine). A highly characteristic creature of the shortgrass plains; also, a rather common resident of the Alleghanian parklands, and in scattered colonies on isolated patches of pseudo-prairie within the southern limits of the Canadian Zone. Maximum numbers per square mile are found in grasslands of the southwest; diminishing populations east to about the longitude of La Broqueri. Occurs sparingly in the interlake district and, west of Lake Manitoba, north to at least Lake Dauphin, Fork River, Gilbert Plains and Roblin. Four specimens from Carman and Lake Audy Plains, Riding Mountain, have average measurements of 293, 79, 48.2 (280, 75, 45—310, 87, 50) mm. Mean weight of adults is about 300 grams.

STRIPED GROUND SQUIRREL *Citellus tridecemlineatus tridecemlineatus* (Mitchell).

This species has a somewhat greater provincial range than *C. r. richardsonii* but seldom attains the localized abundance of that animal. Development of colonies is not so apparent. Local in the entire south (in Transition and Canadian zones) from Sandilands Forest Reserve and Lake Jessie, Winnipeg River, west into Saskatchewan (including Turtle Mountain) and north to Thalberg, Icelandic River, Moosehorn and Birtle.

In all, eight examples were collected at Whitemouth and Cedar lakes, Mowbray, Pine Ridge, Woodlands and Stonewall; these average 280.8, 95.9, 40.1 (257, 67, 38—300, 110, 42) mm. Weight of two adults: female, 163.3 and male, 170.4 grams. Criddle (1939) gives a mean weight of 152 grams for both sexes. The species is generally more or less common on the lowlands east and west of Red River and the plains from Winnipeg to Brandon. Over extensive tracts of its western Manitoba range, however, it seems to be scarce or absent. For the most part, the animals appear to be more numerous east of the range of Richardson ground squirrel and scarcest where the latter is most plentiful in southwestern districts. It is certain that *tridecemlineatus* is now less abundant and uniformly dispersed than in earlier times; cultivation has destroyed large areas of the preferred, primitive grasslands.

NORTHERN STRIPED GROUND SQUIRREL *Citellus tridecemlineatus hoodii* (Sabine). *Hoodii* is more northerly than the preceding subspecies; it is found chiefly within the Canadian Zone. Its known range extends from Riding Mountain and Swan River northwest to Prince Albert National Park, Saskatchewan. Eight specimens taken on Riding Mountain (Lake Audy, Vermilion River, Kennice and Swanson creeks) have average measurements of 276.8, 92, 39.2 (258, 60, 36—292, 103, 40) mm; mean weight, 178 grams. It was also personally observed at Roblin, Gilbert Plains, Dauphin, and points north to Ethelbert. Between the latter place and the settled country north of Duck Mountain, the animals appeared to be very scarce or absent. However, they were found sparingly in the Swan River district and north to about Bowsman. Criddle (1939) located it still farther north at Bell River, east of Mafeking.

FRANKLIN GROUND SQUIRREL *Citellus franklinii* (Sabine). Widely distributed in south from the Ontario border to Saskatchewan and north, in the west, to The Pas district. Essentially a native of the Transition Zone, where it is most numerous, but it also penetrates the Canadian for a considerable distance—as, for example, in southeastern Manitoba and from Riding Mountain northward. My northernmost records of occurrence are for Moose Lake, The Pas and Carrot River Valley. The six specimens collected at Whitemouth Lake, Vivian, Anola and Stonewall, respectively, average 373, 138.8, 50.9 (360, 132, 49—381, 150, 55) mm; mean weight of adults is about 450 grams, the males being about 10 percent heavier than females. In some places the animals are notably common and gregarious. They also undergo marked fluctuations in numbers from time to time. An excellent life-history paper was written by Sowls (1948) dealing with *franklinii* at Delta, Lake Manitoba.

GRAY EASTERN CHIPMUNK *Tamias striatus griseus* Mearns. Found in most of extreme southern Manitoba. It has been recorded from Whiteshell Forest Reserve, Lake Jessie and Whitemouth Lake, west to Rock and Pelican lakes and Turtle Mountain, and north to Icelandic River, Riding Mountain and Dauphin. Over extensive tracts of this general range the animals are very localized, widely scattered, scarce or apparently absent. Moderate abundance is displayed in parts of Red River Valley and some localities to the west.

Average measurements of six specimens collected at Pine Falls, Oakbank, Fort Garry and Turtle Mountain are 260.8, 103, 35.7 (247, 83, 33—272, 113, 36.5) mm; 111.0 (104.5—116.1) grams. Two gravid females were taken on May 4 and 10; one held six fetuses averaging 52 mm in length, the other eight fetuses with a mean of 16 mm.

LITTLE NORTHERN CHIPMUNK *Eutamias minimus borealis* (Allen) (Figure 12). Inhabits an extensive territory westward from Red River to southeastern Saskatchewan, north to Porcupine Mountain, and beyond in forested lowlands north and east to about latitude 54°30'N. It is fundamentally a creature of the Canadian Zone where maximum abundance is reached; it also occurs widely, if erratically, in some scetions of the Transition (Criddle, 1943).

Specimens of *borealis* were collected at Mowbray, Turtle Mountain, Antler and Souris rivers, Riding and Duck mountains,

FIGURE 12. Little northern chipmunk.

Overflowing River and Atikameg Lake. Nearby to the north and northeast it intergrades with *hudsonius*. Twenty specimens have average measurements of 215, 75.8, 30.9 (208, 74, 28.5—230, 103, 32.5) mm; 42.9 (35.9—50.3) grams.

HUDSON BAY CHIPMUNK *Eutamias minimus hudsonius* Anderson and Rand. A more northern form than *borealis*, intergrading with the latter from a little north of Atikameg Lake, eastwards for some distance, and there thought to intergrade with *jacksoni* in perhaps the vicinity of Oxford and Gods lakes. *Hudsonius* occupies the upper part of the Canadian Zone and ranges for an undtermined distance northward into the Hudsonian. Carefully identified specimens have been taken at Flin Flon, Thicket Portage, Bird and Herchmer (57°24'N). In some favorable areas it is plentiful, showing preference for open woods, slashings and sandy, brushy ridges. Average size is about 218, 80, 31 mm; weight approximately 45 grams.

LAKE SUPERIOR CHIPMUNK *Eutamias minimus jacksoni* Howell. Presumably it is this form that replaces *borealis* in the coniferous forest of southeastern Manitoba (Jackson, 1957). Individuals from this area were formerly referred to *E. m. neglectus*. Limits of range to the north (east of Lake Winnipeg) are not known. Specimens now inferentially assignable to *jacksoni* were collected at Whitemouth Lake, Sandilands and Whiteshell forest reserves, Whitemouth River (near Reynolds) and Cedar Lake. Average measurements of 15 specimens: 207, 102.4, 31.7 (185, 73, 31—222, 107, 32.5) mm. A male from Red Rock Lake weighed 51.7 grams.

Examples were also sighted at Winnipeg and Brokenhead rivers, Tyndall and Pine Ridge. Specimens from the latter localities are likely to show intergradation with *barealis*. To the east and north of Lake Winnipeg *jacksoni* intergrades with *hudsonius*, possibly in about the latitude of Cross, Oxford and Gods lakes.

MINNESOTA GRAY SQUIRREL *Sciurus carolinensis hypophaeus* Merriam. A comparatively recent addition to the list of Manitoba mammals. Seton (1909a) did not mention it. At first the species was known only from points in, or near, upper Red River Valley; eventually it spread north as far as Lockport and Lake Winnipeg. Now we have additional records of occurrence at Lake Jessie (Winnipeg River); Lowe Farm, west of Morris; Pembina Hills; Portage la Prairie; Delta and Treesbank. The animals are obviously spreading north and west with the passage of time. Two females taken near North Winnipeg measure 490, 230, 69 and 491, 233, 77 mm, respectively.

HUDSON BAY RED SQUIRREL *Tamiasciurus hudsonicus hudsonicus* (Erxleben). This race inhabits almost all of the province, except the extreme southern part; that is from about Whitemouth River west to Saskatchewan, approximately south of Assiniboine River. Roughly north of this line it is to be found in varying numbers almost everywhere in suitable upper Transition parklands and the Canadian Zone; also, in similar environment east of Red River south to Lake of the Woods. It ranges north to the Hudsonian Zone, as at Churchill and Nueltin Lake (Harper, 1956), there showing signs of intergradation with *T. h. preblei*.

A series of 31 specimens was taken at Whitemouth Lake, Sandilands and Whiteshell forest reserves, Marchand, Icelandic River, Riding and Duck mountains and Overflowing River; these average 317.1, 126.9, 48.6 (299, 100, 46—332, 133, 50.2) mm. Mean weight of seven examples: 217.3 (162.1—271.6) grams. It evidently intergrades with *T. h. preblei* in the extreme northwest.

MINNESOTA RED SQUIRREL *Tamiasciurus hudsonicus minnesota* Allen. Only a comparatively recent discovery added this race to the fauna of Manitoba. It apparently occupies a restricted territory in and adjacent to Red River Valley north to about Lake Winnipeg and westward, on the second prairie steppe, from Pembina Hills possibly to about Brandon. The limit of its Manitoba range is somewhat obscure, but the race is clearly confined to the Alleghanian parklands. Intergradation with *hudsonicus* is to be expected to the east and north, and with *pallescens* to the southwest. Seven specimens assigned to this form were collected at Birds Hill, Oakbank and Pine Ridge, the average measurements of which are 318.8, 129.4, 42.9 (308, 115, 47.7—325, 139, 51) mm. Presumed examples of *minnesota* were seen, also, at Letellier, St. Norbert, Sanford, Fort Garry, Lake Francis, Douglas, Rock and Pellican lakes, Carberry and Killarney.

NORTH DAKOTA RED SQUIRREL *Tamiasciurus hudsonicus pallescens* Howell. This paler race inhabits Turtle Mountain and wooded parts of Souris River Valley on both sides of the International Boundary. As yet the amount of material collected is insufficient to determine the northern and eastern limits of range in relation to *minnesota*. Seven specimens taken at Max and William lakes, Turtle Mountain, average 319.3, 128.3, 49.7 (305, 124, 48—330, 135, 57) mm. Weight of four examples: 198.1 (181.2—210.2) grams.

HUDSON BAY FLYING SQUIRREL *Glaucomys sabrinus sabrinus* (Shaw). Occupies the Canadian Zone throughout the province from Lake of the Woods northwest to Riding Mountain and northwards to the Hudsonian Zone and Hudson Bay. It is, with few exceptions, not common anywhere, but as it is active only at night, it could well be more numerous than the records show. Rand (1948, p. 146) stated that during the trapping season of 1945-46, in the Flin Flon district, R. W. Bryenton captured over one hundred of these squirrels in sets made for other fur bearers.

It is well known that flying squirrels are fond of frozen meat and that such baits are responsible for their accidental capture during the winter months. They appear to be much less readily attracted to trap sets in summer, which at least partly explains the poor success in securing good series of scientific specimens.

From wardens, woodsmen and professional trappers, the writer has oral reports of occurrences at Lake Jessie; Riding, Duck and Porcupine mountains; Overflowing River; Swan River and The Pas. A male secured at Whiteshell River measured 286, 127, 38 mm and weighed 130.2 grams.

PALLID FLYING SQUIRREL *Glaucomys sabrinus canescens* Howell. The type locality, Portage la Prairie, was designated by Howell in 1915. Little additional knowledge of the race has been acquired since that time in Manitoba. However, it is now known to inhabit the full length of the wooded valleys of the Red River and the Assiniboine, west to at least Treesbank, and south through Pembina Hills and other timbered tracts into North Dakota. Northern and western limits of range are not well defined.

Canescens has been collected at Morden, Treesbank, Aweme, Carberry, Portage la Prairie, Winnipeg and Poplar Point Lake (3 miles south of Lake Winnipeg). In heavy mixed woods of the latter locality I secured two specimens on January 22, 1944; a male measured 292, 128, 40 mm and weighed 156.6 grams and a female 302, 130, 40.5 mm and 171.4 grams. To the northwest, *canescens* may occur as far north as the southern slopes of Riding Mountain. A mounted specimen in the park museum at Wasagaming (examined shortly after capture at East Gate), is so pale as to appear referable to this race.

On February 3, 1944, Art Anderson of Poplar Point Lake examined a wood duck nesting box occupied by a pair of flying squirrels; in the soft nesting material he found three slightly furred juveniles with a body length of about 2.5 inches. Mr. Anderson stated that from their appearance they must have been at least two weeks old and, therefore, were born about January 20. This is clearly an extraordinarily early birth date for flying squirrels, especially in view of prevailing latitude and subzero temperatures. Mr. R. Sutton informed me that at Headingly on May 21, 1955, he found a nest of *canescens* containing several young; they were furred, with eyes open, but in the nestling stage and too small to travel.

RICHARDSON POCKET GOPHER *Thomomys talpoides talpoides* (Richardson). This race inhabits prairie-parklands and certain Canadian Zone areas of western Manitoba above the range of *T. t. rufescens*, that is approximately north of latitude 50°30′. It was found as far north as Swan River and Bowsman, where the animals were locally abundant.

A series of 11 specimens was collected at Riding Mountain (Lake Audy; Kennice and Swanson creeks); Lake Dauphin; Watjask Lake, Duck Mountain; and Swan River; these averaged 226.8, 66.6, 33.6 (209, 59, 28—234, 75, 32) mm. Mean weight of four examples: 137.3 (120—168.9) grams. A melanistic individual was captured in the latter locality. Numerous signs of occurrence were also noted on the trip from Minnedosa by way of Birtle to Roblin and at Gilbert Plains, Fork River and Garland.

DAKOTA POCKET GOPHER *Thomomys talpoides rufescens* Wied-Neuwied. Ranges throughout the Alleghanian parklands and some purely campestrian areas. In extensive tracts the animals are irregularly dispersed, scarce or absent; on the other hand, particularly favorable localities are profusely populated. West of Red River, *rufescens* may be said to occupy the country roughly south of 50°30′N., but with some minor extensions to the north. It is scarce east of Red River. However, a few workings were seen at Pine and Green ridges, Ste. Anne, Otterbourne, and east to about the longitude of Woodridge.

The 12 specimens collected at La Broquerie, Rineland, Mowbray, Oak and Louise lakes and Breaden Lake, Turtle Mountain, have average measurements of 226.7, 63.8, 30.8 (207, 55, 29—242, 72, 32) mm. Mean weight of five individuals: 140.3 (117—153.7) grams. Gopher workings were also seen at Notre Dame de Lourdes; Swan, Pelican and Douglas lakes; Souris and Elkhorn. Criddle (1930) has given a painstaking account of this rodent in southern Manitoba.

MISSISSIPPI VALLEY POCKET GOPHER *Geomys bursarius bursarius* (Shaw). This distinctive species was at last added to the Manitoba list when I took specimens near the International Boundary, 11.5 miles east of Emerson, on May 15, 1943 (Soper, 1944). Average measurements of 10 adults: 272.7, 83.6, 35.2 (241, 72, 33.5—298, 86, 36.5) mm; 253.3 (220—343) grams. Fresh earth mounds assumed to be those of *bursarius* were also seen from near Emerson, east for about 20 miles, or to within 11 miles of Roseau River; the calculated band of occupation appeared to be no more than three or four miles in width; it is the only place in which the species is known to occur in Canada. In view of the above findings, it was later thought that the animals might also inhabit similar lowlands along the border west of Red River, but trapping at several likely points west, to beyond Gretna, yielded only *T. t. rufescens*.

MAXIMILIAN POCKET MOUSE *Perognathus fasciatus fasciatus* Wied-Neuwied. Confined to the southwestern region in Campestrian and lower Alleghanian Subfaunal divisions where it occurs, locally, from about the sandy skirts of Spruce Woods Forest Reserve west and southwest to Saskatchewan and North Dakota. Three specimens secured at Treesbank and forks of Antler and Souris rivers, average: 129.3, 61.3, 16.7 (125, 57, 16.5—135, 64, 17) mm. Weight of one inidividual—9.9 grams. It has also been taken at Aweme (Criddle, 1915, 1929) and Oak Lake (Anderson, 1946). The species appears to resort only to those locations with sandy or very light soils; for this reason occurrence is irregular and communities are widely scattered. In some places it is fairly numerous or common. Habitat is variable, from semiarid, treeless Upper Sonoran plains, to thin grasslands in the aspen grove belt.

CANADA BEAVER *Castor canadensis canadensis* Kuhl. This remarkable quadruped was once more or less abundant over most of the province, but was seriously decimated by the beginning of the century, if not sooner. In many areas it became very rare, or completely exterminated. However, with highly effective conservation and restocking procedures of more recent times, the species has made amazing recovery.

In a recent letter, Mr. G. W. Malaher, Director of Game, remarks: "The streams of southern Manitoba are full of beaver, as well as the north country. Their lodges [Figure 13] are even to be found on both the Red and Assiniboine Rivers within the City of Winnipeg and its suburban municipalities. Last year [1958] we took 30,000 beavers... the highest on record for over half a century. In fact, it is the highest record we have".

LABRADOR WHITE-FOOTED MOUSE *Peromyscus maniculatus maniculatus* (Wagner). Ranges along the eastern border in the Canadian Zone, north to at least the latitude of York Factory and westward nearly to, or into, northern Saskatchewan. Intergrades with *borealis* in the latter region and with *bairdii* along the southern fringe of the mixed-wood forest from about west-central Manitoba southeast to the vicinity of Whitemouth River. Specimens (determined by National Museum of Canada as *maniculatus*) were obtained at Marchand; Whitemouth, Red Rock, Jessica and Caddy lakes; Vivian; Whitemouth River; Telford; Pine Falls and Lake Jessie, Winnipeg River; The Pas and Atikameg Lake.

Twenty-three specimens from the above localities have average measurements of 179.9, 86.5, 20.5 (166, 70, 19.1—194, 100, 22) mm; 24.7 (24—28.1) grams. Anderson's (1946:135) omission of *maniculatus* in eastern Manitoba is an apparent oversight. At times these little rodents may be very plentiful, or again, surprisingly scarce. Average capture rate from 1935 to 1947 was 5.3 individuals per 100 trap-nights; the highest, 15 per 100 in 1938; the lowest, one in 300 at The Pas in 1947. The Pas specimens exhibit some approach to *P. m. borealis*.

MACKENZIE WHITE-FOOTED MOUSE *Peromyscus maniculatus borealis* Mearns. Has limited and dilute representation in upper west-central Manitoba, intergrading with *maniculatus* to the eastwards and with *bairdii* to the south along the Manitoba-Saskatchewan border. In the latter section a perplexing interfusion of racial values prevails in a complex of *borealis-bairdii-osgoodi* intergradation. Typical examples of the present form are to be found a short distance to the west in at least the Hudson Bay Junction—Melfort, Saskatchewan, latitude and northward. No typical material was personally acquired in Manitoba. This race averages a little larger than *bairdii*. A series of *borealis* from nearby Saskatchewan has mean measurements and weight as follows: 164.4, 70.5, 20.1 mm; wt. 23.9 grams.

OSGOOD WHITE-FOOTED MOUSE *Peromyscus maniculatus osgoodi* Mearns. This pale-colored subspecies is basically a resident of the dry southern plains, but it also penetrates the semiopen outskirts of the Alleghanian parklands to a certain extent. Recognizable intergrades with *bairdii* occur well into south western Manitoba (Souris River; Oak and Pelican lakes; Aweme; Spruce Woods Sandhills). Moreover, some individuals so closely resemble unequivocal *osgoodi* from much farther west that it is justifiable to accord this form proper recognition as a part of the Manitoban fauna. It is true, nevertheless, that *bairdii* characters are increasingly dominant east of about longtitude 102°W, and that numerous individuals cannot, with finality, be assigned to one race or the other.

To the east, *osgoodi* coloration may be said to finally taper off into essentially typical *bairdii* in about the longitude of Rock Lake and, to the northwest, in the

FIGURE 13. Beaver lodge in winter in the northern forest.

general neighborhood of Qu'Appelle River. (Refer to racial comments under *borealis*.) *Osgoodi* and *bairdii* agree closely as to size. A large series of the former from Saskatchewan have average measurements and weight of 153.1, 61.7, 19.9 mm and 23.2 grams.

BAIRD WHITE-FOOTED MOUSE *Peromyscus maniculatus bairdii* (Hoy and Kennicott). A somewhat dusky form associated, for the most part, with the more humid Alleghanian parklands of the Transition Zone. It reaches the northwestern limits of its geographic distribution in southwestern Manitoba; here it undergoes an almost imperceptible synthesis with *osgoodi* to the west, with *borealis* to the northwest and with *maniculatus* to the north and east. On the perimeter of its range, numerous intergrades are extremely puzzling and defy subspecific identity with any accuracy (Soper, 1946). Color confusion seems most marked in the extreme southwest (*bairdii—osgoodi* complex) and in the lowlands west of Lake Winnipeg to and around Lake Manitoba (*bairdii* + *maniculatus*).

Specimens referred to *bairdii* (typical, or subtypically nearer this race) were collected at Mowbray; Rock, Louise, Pelican, Douglas and Oak lakes; forks of Antler and Souris rivers; Treesbank; Turtle Mountain; Winnipeg; Stony Mountain; Lake Francis; Elm and Leffura points, Lake Manitoba; Dog, Little Salt and Dauphin lakes; Mossy River and Riding and Duck mountains. Even in some of the above localities, along the southwestern and northeastern perimeter, some individuals are nearer to *osgoodi* and *maniculatus*, respectively.

A series of 61 specimens from the localities cited above have average measurements of 155.6, 64.8, 19.3 (142, 57, 18—169, 81, 20) mm. Mean weight of 26 examples: 22.1 (17.1—27.2) grams. Two females taken at Lake Louise, June 16, 1937, contained six and seven embryos, respectively; another at Stony Mountain, June 28, with five fetuses averaged 15 mm in length.

Bairdii is abundant at certain times and places, but it can also slump to low numerical levels. The long-time average rate of cap-

ture was only one per 100 trap-nights; the highest, 20 per 100 (Pelican Lake, 1940); the lowest, one in 360 (Little Salt Lake, 1947). It was locally common from 1937 to 1939 and exceptionaly scarce in 1935-36 and again from 1941 to 1943. Criddle (1950) wrote an unexampled account of this race in the Spruce Woods—Aweme district covering the period 1928 to 1947.

MAXIMILIAN GRASSHOPPER MOUSE *Onychomys leucogaster leucogaster* (Wied-Neuwied). Found only in the southwestern portion of the province where it is of sparing and capricious distribution. The species resorts to both open campestrian country and the Alleghanian parklands a little farther north and east. Seton (1909a) captured one at Carberry on June 1, 1884. The eastern limit of occupation appears to be Red River Valley (near the 49th parallel); the northernmost record in Manitoba is by Green (1932), who took specimens along the southern edge of Riding Mountain National Park. Criddle (1929) reported the species as "tolerably common" at Aweme, and Anderson (1946) records a specimen from Oak Lake. In August 1949, Mr. R. Sutton secured a specimen in the vicinity of Melita and another near Boissevain. This race intergrades with *missouriensis* in southeastern Saskatchewan. Average measurements of these mice are about 150, 39, 21.5 mm.

GRAY BUSHY-TAILED WOOD RAT *Neotoma cinerea* ssp. (Figure 14). There is one accidental occurrence of this species in the province—plainly an exotic far from its normal haunts. Mr. R. Sutton, Manitoba Museum, informed me that one was captured not long ago in the Canadian Pacific Railway shops in Winnipeg, and that he still has it alive in captivity. As he says, "It probably arrived in a carload of manila rope from the Pacific coast."

RICHARDSON VARYING LEMMING *Dicrostonyx groenlandicus richardsoni* (Merriam). This lemming is an inhabitant of the Arctic Barren Grounds. In Manitoba it occupies the strip of coastal tundra from a low, sandhill tract south of Cape Churchill northward over a wide area to and in southern Keewatin District, N.W.T. Preble (1902) reported the animals as common from Fort Churchill (type locality) north along the coast to about Cape Eskimo. On August 9, 1931, I saw many signs of *richardsoni* on sandy uplands north and west of old Fort Prince of Wales. Preble likewise found the

FIGURE 14. Gray bushy-tailed wood rat.

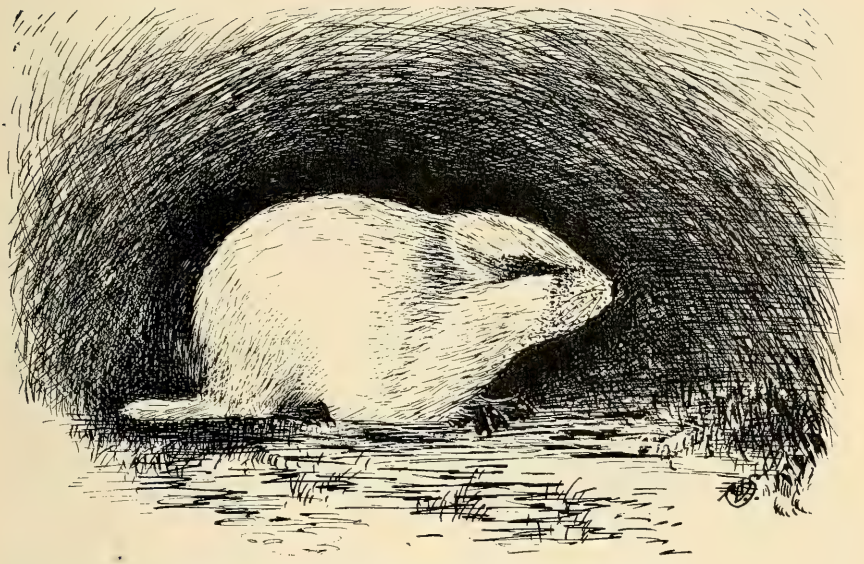

FIGURE 15. Richardson varying lemming in winter coat.

animals plentiful on sand ridges south of the river and west of the Churchill townsite.

Subsequently, several biologists (*see* References) found the animals in various stages of relative abundance in the latter district. Like the brown lemming, this species has cycles of about 4.5 years; recent peaks of abundance appear to have been in 1948—49 and 1953—54. This is the lemming that turns white and develops heavy claws on the forefeet during the winter months (Figures 15 and 17*B*). Average adult measurements are about 130, 12, 18 mm; mean weight, approximately 65 grams.

COOPER LEMMING VOLE *Synaptomys cooperi cooperi* Baird. From wide distribution in the east, this little vole ranges westward into a restricted area of Canadian Zone bogs and muskegs in the southeastern corner of the province. Northern limits of range in Manitoba are not known. Two specimens were collected by Stuart Criddle in 1912 and 1929 near Dawson (Sandilands Reserve); Green (1930) records *cooperi* from Pine Falls, Winnipeg River; and Buckner (1957) took specimens near Rennie. These appear, as yet, to be the only points of capture in Manitoba.

MANITOBA LEMMING VOLE *Synaptomys borealis smithi* Anderson and Rand. Ranges through Hudsonian and Canadian zones in Manitoba from Churchill (Quay, 1955; Smith and Foster, 1957) south to about Lake of the Woods and northwest, locally, to Riding Mountain, Flin Flon and Prince Albert National Park, Saskatchewan. Seton (1909) was justified in assuming that *S. borealis* occurred in Manitoba.

In 1929 Stuart Criddle collected several examples near Dawson Cabin; Green (1930) took specimens at Pine Falls, Winnipeg River; Breckenridge (1936) caught an adult at Cormorant Lake; and I took one on May 12, 1937, near Larkhall. In 1938 Richard Sutton trapped two individuals near Clear Lake, Riding Mountain (Soper, 1952). On the west side of the province *smithi* probably ranges north almost to the District of Keewatin. Average size is about 120, 23, 19 mm.

BACK BROWN LEMMING *Lemmus trimucronatus trimucronatus* (Richardson) (Figures 16 and 17*A*). Quay (1955) evidently established the first record of this species in Manitoba when he trapped a single individual at Churchill during the third week of August, 1953. The previous southernmost record, along the coast, was for the mouth of Thlewiaza River (approximately 60°15'N) where Preble (1902) found the animals common in early August, 1900. Quay's discovery thus extends the known range of the species about 100 miles south of that previously established. Average measurements of these Arctic rodents are approximately 125, 18, 19 mm.

DAWSON RED-BACKED VOLE *Clethrionomys rutilus dawsoni* (Merriam). So far as known, this sub-Arctic—Arctic species has been taken in Manitoba only in the extreme northeastern coastal region where open tundra prevails. In 1935 at Nonala, Manitoba, 80 miles north of Churchill, Breckenridge (1936) captured an individual, which was subsequently identified by H. H. T. Jackson, U.S. Biological Survey. Evidently this is the only Manitoba record. *Dawsoni* is essentially a creature of the Hudsonian Zone with a wide range west to Yukon and Alaska and locally north to the Arctic mainland coast. It is considerably brighter in color than the "redbacks" of the *gapperi* group farther south. In size it is about the same as *C. g. hudsonius*.

GAPPER RED-BACKED VOLE *Clethrionomys gapperi gapperi* (Vigors). A Canadian Zone form with provincial distribution from about Lake of the Woods northward; it probably meets the range of *C. g. hudsonius* in about latitude 56°. Specimens from southeastern Manitoba are provisionally referred to *gapperi* until further research can be carried out. Specimens do not appear to be precisely typical *gapperi*, but they are nearer to that race than to *loringi*.

Specimens tentatively referred to *gapperi* were collected at Marchand; Sandilands; Whitemouth Lake and River; Pinawa and Pine Falls. Those from Marchand, Sandilands, Pinawa and Pine Falls appear to be intergrades with *loringi*. The series of 18 specimens from the cited localities average 131.8, 34.9, 18.6 (122, 32, 18—144, 39, 20) mm. Mean weight of seven examples: 22.1 (16.5—25) grams. While usually fairly common, to plentiful, these voles at times become very scarce. Over the years the average rate of capture was 4.7 per 100 trap-nights; the highest, 11 per 100 (Marchand, 1943); the lowest, 0 in 210 (Caddy Lake, 1935).

HUDSONIAN RED-BACKED VOLE *Clethrionomys gapperi hudsonius* Anderson. Distributed in the upper reaches of the Canadian Zone and the adjacent Hudsonian of northeastern and north-central Manitoba from about latitude 56° (near Ilford) north to Churchill and Sandhill Lake (Anderson, 1946; Manning, 1948). Intergrades with

FIGURE 16. Back brown lemming of the Arctic tundra.

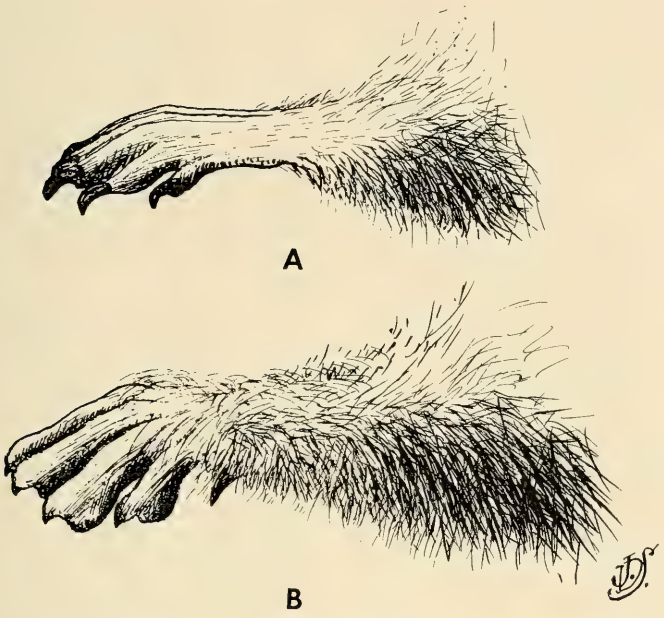

FIGURE 17. *A*, Front foot of the brown lemming (*Lemmus trimucronatus*); *B*, front foot of Richardson varying lemming (*Dicrostonyx groenlandicus*), showing greatly enlarged winter claws.

gapperi in the southeast and with *athabascae* in the northwestern part of the province. Smith and Foster (1957) found these voles very numerous in the Churchill district from 1953 to 1955. The most favored habitat consists of dense, moist, lowland woods and the margins of bogs and muskegs, but the animals also inhabit higher ground in lesser numbers. In the Churchill area, and elsewhere, a few range into neighboring open tundra. Mean measurements approximate 140, 40, 19.5 mm; 27.4 grams.

ATHABASCA RED-BACKED VOLE *Clethrionomys gapperi athabascae* (Preble). Undoubted examples of this race were personally collected only at Atikameg Lake (July, 1947), northeast of The Pas. It inhabits northwestern Manitoba north of *loringi* and west of the range of *hudsonius*. Rand (1948) records *athabascae* for the Flin Flon district and Harper (1956), likewise, for the Nueltin Lake—Windy River area in Manitoba and Keewatin. The four Atikameg Lake specimens average 138, 37.3, 18.3 (130, 36, 17—146, 38, 19.2) mm; 23.3 (17.2—28.9) grams. They were very scarce in 1947 and widely scattered on spruce—poplar uplands.

PLAINS RED-BACKED VOLE *Clethrionomys gapperi loringi* (Bailey). A normally common resident of Campestrian and Alleghanian subdivisions of the Transition Zone (approximately west of Red River), where it lives in brushy valleys of the open grasslands and in aspen or aspen—bur oak woods of the parklands. It also ranges in mixed-wood forest along the western side of the province. In the south, dry uplands is clearly the preferred habitat. In the Canadian Zone, however, it invades moist lowlands, bogs and sphagnum muskegs to a limited extent.

Individuals unreservedly assigned to this form were taken at Fort Garry; Stony Mountain; Pine Ridge; Icelandic River (Arborg); Douglas, Rock, Louise and Oak

lakes; Turtle Mountain; Antler and Souris rivers; Little Salt, Shoal and Dog lakes; Leffura and Elm points, Lake Manitoba; Riding and Duck mountains; and Mossy and Overflowing rivers. In the west-central region it probably intergrades with *athabascae* in about latitude 50°30'N.

A total of 64 specimens was collected in the localities cited. These average 132.5, 35.6, 17.9 (123, 32, 17—148, 42, 19.3) mm. Mean weight of 25 individuals: 22.3 (18.2—24.9) grams. A female taken at Rock Lake on May 14, 1942 (wt. 24.9 grams), carried six fetuses with a mean length of 15 mm.

Like many other small rodents, *loringi* swings at times from states of abundance to marked scarcity. It was also found to manifest these population extremes in different localities during the same season. From 1935 to 1947, at the points mentioned, a total of 260 individuals was taken in 3,950 trap-nights, or a long-time average of 6.6 per 100 trap-nights. The highest rate prevailed at Overflowing River, October, 1941, with 19 per 100 trap-nights; Riding Mountain, October, 1946, with 12 per 100; and Little Salt Lake, October, 1947, with 11 per 100 trap-nights. Lowest rate of catch occurred at Riding Mountain, June, 1941, with only one in 440 trap-nights. For an excellent long-term study of this vole in southern Manitoba see Criddle (1932).

PRAIRIE PHENACOMYS VOLE *Phenacomys ungava soperi* Anderson. Up to the present time, apparently known in Manitoba only from the type locality at Swanson Creek, Riding Mountain National Park (Anderson, 1942); the type specimen was personally taken there on June 5, 1941 (female 135, 33, 17 mm; 26.8 grams); gravid, with seven embryos averaging 8 mm in length; also, a topotype a short distance to the east, on July 16, 1942 (female 135, 30, 17.5 mm; 21.4 grams). The locality is typified by the usual Canadian Zone features of mixed-wood forest and hummocky lowlands clothed with conifers, sphagnum moss and Labrador tea. The species was evidently very scarce, because, despite hundreds of trap-nights in many other localities on the plateau (2,000 feet) no other individuals were secured.

MACKENZIE PHENACOMYS VOLE *Phenacomys ungava mackenzii* Preble. Ranges in the upper Canadian Zone and through the Hudsonian to at least Malaher Lake, N.W.T. (Manning, 1948). Few locality records exist for northern Manitoba. Several observers have listed it for the Port Churchill area (Preble, 1902; Anderson, 1942; Smith and Foster, 1957), and Rand (1948) records a phenacomys from the Flin Flon district, where it is rare. The animals were plentiful in the Churchill country during 1954 and 1955; a few were taken on the open tundra several hundred yards from the nearest trees. The favorite habitat was dry, open, white-spruce woods with log and stump litter and scanty vegetation. Average measurements of *mackenzii* are about 131, 32, 19 mm; 27.4 grams.

KEEWATIN MEADOW VOLE *Microtus pennsylvanicus aphorodemus* Preble. Type locality: near mouth of Thlewiaza River, Hudson Bay, a few miles north of the Manitoba boundary (Preble, 1902); also taken by Breckenridge (1936) at Nonala, Manitoba, about 20 miles to the south. Various authors (Preble, 1902; Anderson, 1937 and 1946; Rand, 1943; Smith and Foster, 1957) individually regard Churchill specimens as either referable to the present race, or to *drummondii*, or as intergrades between the two. The latter authors list their Churchill specimens under *aphorodemus*, but are open-minded with respect to the occurrence of intergrades. Average measurements of Churchill adults are approximately 147, 37, 19 mm. The animals were abundant in this area from 1952 to 1954.

DRUMMOND MEADOW VOLE *Microtus pennsylvanicus drummondii* (Aud. and Bach.). This familiar vole ranges over most of the land surface of the province, in suitable habitats north to about the upper limits of the Hudsonian Zone; that is, vicinity of Churchill (Anderson, 1946) and Nueltin Lake (Harper, 1956). It is equally abundant, periodically, in humid parts of the Transition (Alleghanian) and Canadian zones. Lesser numbers usually exist in the dryer grasslands of the campestrian southwest.

Drummondii was personally collected, or observed, in about 40 well-spaced localities across the south from Whitemouth Lake to the Saskatchewan border and north to Driftwood and Atikameg lakes. The 43 specimens collected have average measurements of 151.5, 41.7, 19.1 (136, 31, 17.5—168, 48, 20.5) mm and a mean weight of 35.9 (31.2—49.4) grams. Fluctuations in numbers are very pronounced from time to time, and there are marked, simultaneous differences

in population levels from one locality to another. At Aweme, Criddle (1956) found these voles abundant in the years 1928-29, 1935-37 and 1944, and scarce, or rare, in 1930-34, 1938, 1942 and 1949-50.

The long-time capture index was 3.4 individuals per 100 trap-nights; highest, 15 per 100 (Blue Lakes, Duck Mt., Oct. 1944); lowest, one in 160 (Caddy Lake, May, 1935); and zero in 240 trap-nights (Vermilion River, Riding Mountain, May 1941). Some breeding data is afforded by two gravid females as follows: Rock Lake, May 14, 1942, eight fetuses averaging 20 mm in length; Turtle Mountain, September 20, 1943, four embryos with a mean length of eight millimeters.

CHESTNUT-CHEEKED VOLE *Microtus xanthognathus* (Leach). Originally described from Hudson Bay (type specimen not known). Knowledge of distribution in Manitoba is very limited. Preble (1902) points out that the species had been collected at or near the mouths of Nelson and Churchill rivers; these are apparently the only records for the province.

Xanthognathus appears to be of very localized and sporadic distribution and subject to violent fluctuations in numbers. Occasionally it has been found common in some parts of its geographic range; again, it may be totally absent in the same places in later years. To many collectors it has been a veritable will-o'-the-wisp. Ordinarily, presence of the species is easily detected, as it digs relatively large, deep burrows with generous quantities of earth thrown out at the entrances; well-trodden trails connect the burrows which are usually located on well-drained land. This is a big, handsome microtine with average measurements of about 215, 50, 26 mm.

LITTLE UPLAND VOLE *Pedomys ochrogaster minor* (Merriam). Occupies southern parts of the province in Alleghanian parklands and Campestrian plains from east of Red River, west to Saskatchewan, and north to isolated grasslands on Riding Mountain. Characteristically a creature of the prairies, it also resorts to scattered shrub-grasslands and, less frequently, similar habitats in open deciduous woods. *Minor* is often found in small colonies—habitually so in winter—but tends to be more withdrawn and semisolitary during the breeding season from May until August or September. The summer homes are marked by diminutive but well-defined burrows, and runways are often many yards long.

A series of 32 specimens was collected in various years near Ridgeville, Fort Garry, Lake Louise, Aweme, and forks of Antler and Souris rivers; average measurements of these are 131.6, 30.6, 15.6 (118, 22, 15—146, 36, 18) mm; mean weight of 9 examples: 23.7 (20.4—30.3) grams. A subadult captured at Aweme on June 15, 1937, was three-quarters adult size (89, 22, 15 mm) and three juveniles trapped at Ridgeville on May 16, 1943, were about one-third grown with respective weights of 8.1, 8.3, and 9.2 grams. Although capriciously distributed and apparently more often scarce, in a few instances it was found locally common.

EASTERN MUSKRAT *Ondatra zibethicus zibethicus* (Linnaeus). Little is known about this form in Manitoba, but evidently it occurs throughout the mixed-wood forest region of southeastern districts in typical, or slightly subtypical form. Two specimens collected at Whiteshell River in late October, 1946, are fairly close to *zibethicus* in color and much too dark for *cinnamominus;* these are: male, 555, 238, 78 mm, wt. 2.5 lbs.; and male, 484, 210, 76 mm, wt. 1.5 pounds. The possible range of the present form in Manitoba is from Lake of the Woods north to about Winnipeg River, but it may go farther north. More inquiry is needed on this question.

HUDSON BAY MUSKRAT *Ondatra zibethicus albus* (Sabine) (Figures 18 and 19). As yet, the provincial range of *albus* is not accurately defined, but it is regarded as generally occupying most of the mixed-wood forest of Manitoba from Nueltin Lake (Harper, 1956) and Churchill (Anderson, 1946), south to about lower Lake Winnipeg, Lake Winnipegosis and Riding Mountain, or, locally, a little nearer to the International Boundary. It intergrades with *cinnamominus* to the south and southwest and is thought to do so with *zibethicus* in the southeast.

Three specimens taken at Whitewater Lake, Riding Mountain; Singoosh Lake, Duck Mountain; and Overflowing River, respectively, measure and weigh as follows: female, 570, 240, 73 mm, 2.75 pounds; male, 475, 220, 72 mm, 1.75 pounds; and female, 466, 206, 68 mm, 1.46 pounds.

FIGURE 18. Muskrat feeding on edge of ice in early winter.

The animals are commonly dispersed; in some favorable areas they are notably abundant. An outstanding example is that of the Saskatchewan Delta–Summerberry Reserve district where, in 1945, a harvest of 372,000 pelts was taken (Game Trails, June, 1945, p. 10).

In a recent communication, Mr. G. W. Malaher provides the following interesting and valuable information: "From work done by Dr. J. A. McLeod on the muskrat in Manitoba during the past 10 years, it would seem that *alba* is the common muskrat of Manitoba, that *zibethica* is likely to be found only in the southeastern section, and that *cinnamomina* is found only sparingly in the southwestern and south-central portions of the province, in areas overlapped by *alba*. Thus, Dr. McLeod reports only *alba* at Oak Lake and mainly *alba* with the occasional *cinnamomina* at Whitewater Lake.

"As to numbers, it is undoubtedly right that the numbers produced today are not indicative of the original population, but I think it significant that here, again, Manitoba has produced a record number of pelts in recent years. In 1955-56, production was 1,462,474. This record is good for the last half century anyway. Again, the average number of pelts taken in the past 20 years far exceeds the average of the previous 20 years, mainly, I believe, because of managed muskrat production on the Summerberry and other Fur Rehabilitation Blocks".

GREAT PLAINS MUSKRAT *Ondatra zibethicus cinnamominus* (Hollister). This paler race, in typical form, is restricted to extreme south-central and southwestern localities. Its range embraces certain parts of both Alleghanian parklands and campestrian sections of the Transition Zone, on the second prairie steppe, where, however, there is considerable intergradation with *albus* (see Mr. Malaher's remarks above).

A series of six specimens collected at Pelican Lake; Breaden and Max lakes, Turtle Mountain; and forks of Antler and Sauris rivers, were regarded by Dr. R. M.

Anderson as unqualified *cinnamominus*, or closer to it than *albus;* these specimens average: 520, 222, 75 (492, 205, 72–595, 270, 79) mm; 1.8 (1.56–2.10) pounds. Criddle (1929) places Treesbank district muskrats under *cinnamominus*, where, as elsewhere, they live variously in streams, ponds and lakes. Recognizable intergrades occur in many southwestern localities. Although the animals are still moderately common there, apparently the overall population has greatly diminished.

NORWAY RAT *Rattus norvegicus* (Berkenhout). A more or less recently introduced species, which evidently first reached the province in 1912 or 1913. Seton (1909) had no personal knowledge of it in Manitoba and Criddle (1929) stated that it was first detected in the Aweme-Treesbank district during 1914. Since then, as an obnoxious pest, it has spread in varying degrees of abundance throughout most southern territory.

HOUSE MOUSE *Mus musculus domesticus* Rutty. With regard to this exotic pest, Seton (1909) remarked: "Introduced with settlers in 1882; now abundant in all towns." It is even more widely dispersed at the present time, one record being from Churchill (Smith, 1957). In summer, large numbers desert barns and houses to roam in the open fields, prairies and woods. Consequently, collectors of small, native mammals often catch these mice far from any towns or farm buildings.

HUDSON BAY JUMPING MOUSE *Zapus hudsonius hudsonius* (Zimmermann). Of wide range, principally in the Canadian Zone, but it also penetrates the Hudsonian. In the more northern latitudes there are positive records for Flin Flon, Ilford, Oxford Lake, York Factory and Churchill. On the whole, this race is replaced by *campestris* near the upper limits of the Transition parklands. Criddle (1929), however, lists *hudsonius* as occurring in the isolated larch bogs of the Aweme

FIGURE 19. Muskrat lodge at a northern muskeg lake covered with snow.

district. The nine specimens collected in southeastern Manitoba (Sandilands and Whiteshell Forest reserves and Pointe du Bois, Winnipeg River) and Atikameg Lake, average 213.8, 131.1, 30.8 (205, 121, 30—218, 138, 31) mm; wt. 18.4 (16.9—21.3) grams.

These mice were generally scarce, rare, or apparently absent in most of the sampled range. Over the span of a decade or so, the average catch was considerably less than one individual per 100 trap-nights; in many Canadian Zone trapping areas none were caught. The highest score obtained—four in 100 trap-nights—was at Red Rock Lake, Whiteshell Reserve, in late May 1943. The species likes moist, willow-alder flats bordering lakes and streams, but a few also travel about on neighboring uplands.

PRAIRIE JUMPING MOUSE *Zapus hudsonius campestris* Preble. As the name implies, this is a mouse of the campestrian region. However. it is usually found in association with scattered shrubbery and semiopen woods of stream valleys, or parklands, as distinct from the bald prairie. It occurs locally in the Transition Zone from points east of Red River, west to Saskatchewan, and north in the interlake counrty and the pseudo-prairies of Riding Mountain. There are records of occurrence for Emerson; Winnipeg; Pine Ridge; Gimli; Portage la Prairie, Mowbray; Carberry; Douglas, Rock, Pelican and Oak lakes; Aweme and Coulter. In all probability, jumping mice seen at Dog and Dauphin lakes were also of this race.

The 12 specimens collected in the above territory average 216.5, 130.9, 29.7 (195, 113, 28—227, 135, 32) mm; mean weight, 17.8 (16.3—20.2) grams. This subspecies is probably as numerous as *hudsonius*. Nevertheless, it has been common at some times and places. Average long term trap-night ratios were almost identical for both races.

These remarkable "jumpers" are not infrequently seen actively abroad in full daylight. In the course of several years I succeeded in catching four by hand in open grasslands. The population level is seemingly rather uniform, but there is some indication of slight periodic fluctuation.

SASKATCHEWAN JUMPING MOUSE *Zapus princeps minor* Preble. Predominant habitat on the Great Plains embraces the semiarid, to subhumid, grasslands of the Transition Zone, with minor incursions within the aspen grove belt. In Manitoba the species seems to be confined to extreme southern localities (on the second prairie steppe) east to about the Pembina Hills escarpment. Throughout this prairie-parklands territory it appears to be erratically dispersed and comparatively rare. It is more plentiful on the third steppe in Saskatchewan.

Minor is not accorded existence in Manitoba by either Seton (1909), Anderson (1946), or Miller and Kellogg (1955), but Criddle (1929) lists it as rare at Aweme. Also, in 1940 and 1941, I collected four specimens at Pembina River, north of Mowbray, and at Pelican Lake; these average 231.5, 139, 30.6 (226, 132, 29.5—240, 145, 31.5) mm. Weights of two specimens: 22.6 and 23.1 grams.

WISCONSIN JUMPING MOUSE *Napeozapus insignis frutectanus* Jackson. An inhabitant of Canadian Zone forests, with western limits of distribution in southeastern Manitoba. The first and apparently only records for the province are based on two of my specimens as follows: Caddy Lake, Whiteshell Forest Reserve, May 24, 1935, male, 241, 151, 31.5 mm, white tail-tip, 26 mm; Cedar Lake (near Vivian), May 8, 1937, male, 243, 146, 32 mm, white tail-tip, 7 mm (Soper, 1937; 1938). In relation to extensive field work, it appears conclusive that this eastern coniferous forest species is very rare in the region under review.

EASTERN CANADA PORCUPINE *Erethizon dorsatum dorsatum* (Linnaeus) (Figure 20). Generally, but usually sparingly, distributed in the Canadian Zone from the southeastern corner of the province northward to York Factory; to about Churchill River, in the north-central area; to Reindeer Lake on the west; and south over Porcupine, Duck and Riding mountains. Criddle (1929) recorded this race locally south to the Spruce Woods —Treesbank district. A few widely scattered individuals were noted as far west (on the first prairie steppe) as Red River, from about Morris north to Lake Winnipeg.

While the animals are common in some southeastern tracts, they are evidently very scarce, or totally absent at the present time, over much of the Manitoban range. Mr. G. W. Malaher has recently informed me that about six years ago there was a pronounced upsurge in numbers throughout Sandilands and Whiteshell forest reserves. An immature female collected on May 12, near Sandilands, measured 625, 190, 93 mm, and weighed 8.5 pounds.

FIGURE 20. Porcupine in defensive position.

NEBRASKA YELLOW-HAIRED PORCUPINE *Erethizon dorsatum bruneri* Swenk. This yellow-haired form, of very sparing occurrence in southwestern Manitoba, can only be tentatively referred to *bruneri*. Little is known about it provincially; more specimens are needed for subspecific clarification. In a letter of July 12, 1939, Mr. S. Criddle stated that a yellow-haired porcupine had been seen near Belmont, Tiger Hills, and another along Assiniboine River a few miles northwest of Treesbank. Mr. L. T. S. Norris-Elye informed me several years ago that the Manitoba Museum has a specimen (without skull) from Lauder.

In a letter during February, 1959, Mr. Malaher stated that "Dr. J. A. McLeod reported a considerable build-up of porcupine in the Spruce Woods Forest Reserve area three or more years ago. He identified one example seen at Hargrave, Manitoba, as the yellow-haired variety and believes that this was the kind then much in evidence. I travelled the Spruce Woods area a good deal last year, but there were then no recent signs of porcupines."

From present information, this yellow-haired type occurs nowhere to the west very far north of the International Boundary. It is more numerous on the third prairie steppe, in Saskatchewan, for some little distance west of the Coteau de Missouri.

Order CETACEA. Whales and Porpoises

WHITE WHALE *Delphinapterus leucas* (Pallas). This little porpoise has been frequently recorded from the west side of Hudson Bay, chiefly in the Manitoban portion and northwards. Schools of several individuals, up to a score or more, have been common during the summer months. They particularly liked to disport themselves in the mouths of Hayes, Nelson and Churchill rivers. In August 1931, the writer saw many swimming and blowing in the harbor of the latter stream. At one time large numbers were killed for their hides and blubber. While the population has declined, many still return to their old haunts.

FIGURE 21. Head of northeastern coyote.

BOWHEAD WHALE *Balaena mysticetus* Linnaeus. In the nineteenth century and earlier, bowheads were generally dispersed in Hudson Bay, but they were always more numerous in the extreme northern end and through the floe-ridden waters of Foxe Channel, Frozen Strait and Roes Welcome. A few roamed the sea off the coast of Manitoba. Preble (1902) remarked: "Formerly found as far south as Churchill River, according to Hearne, who says that three were 'killed there in the course of twenty years'." By about 1903 these leviathians had become very scarce, or completely exterminated in some areas; shortly after, commercial whaling came to an abrupt end. There appears to be no recent record of the bowhead in the region under review.

Order CARNIVORA. Flesh Eaters

NORTHEASTERN COYOTE *Canis latrans thamnos* Jackson (Figure 21). This so-called brush wolf ranges over southern Manitoba north to about Elliot and Cross lakes, Thicket Portage and Pukatawagan. Intergrades with *latrans* evidently occur in the extreme southwestern corner of the province (Young and Jackson, 1951). In many districts it is common, but from time to time it may sharply fluctuate in numbers. Though considerably depleted in settled communities coyotes have an almost uncanny ability to survive persistent hunting, poisoning and trapping.

SASKATCHEWAN TIMBER WOLF *Canis lupus griseoalbus* Baird. The type specimen (formerly *Canis lupus-griseus* Sabine and *Canis lupus knightii* Anderson, 1943) was collected by Capt. John Franklin, R.N., at Cumberland House, Saskatchewan River, in January 1820. The race apparently inhabits most timbered regions of the province, intergrading with *hudsonicus* in the Keewatin District, or possibly extreme northern Manitoba (Young and Goldman, 1944, p. 414), with *lycaon* to the southeast, and with

nubilus on the plains to the southwest. The latter race, however, is now regarded as extinct. Although *griseoalbus* is still common, to plentiful, in remote areas, the population during the past 50 or 60 years has dwindled, or disappeared, in the southern parts of its range. In some northern districts wolves are absent in summer; in the same areas tundra wolves (*hudsonicus*) become common in winter as they follow barren-ground caribou herds from the north. A few wolves still wander south to Sandilands Forest Reserve and Riding Mountain, as well as to some of the northern fringes of settlement.

CONTINENTAL ARCTIC FOX *Alopex lagopus innuitus* (Merriam). These little foxes of the bleak Arctic tundras ordinarily occur along the coast of Manitoba from the District of Keewatin southward to the vicinity of Port Nelson. They have been recorded as far southeast as Severn River and during very severe winters have wandered inland for a distance of 300 miles or more. On several occasions in the northeast they have been seen south of latitude 55°. There is one old and remarkable record of occurrence near Norway House (Preble, 1902).

NORTHERN PLAINS RED FOX *Vulpes fulva regalis* Merriam. Found in about three-quarters of the entire province. It is at home alike in the deciduous parklands and northern coniferous forest north to the Hudsonian Zone.

In peak years the animals still range abundantly in the northern wilderness, as well as in some settled districts of the south. They were scarce in 1928-29, but a few years later became much more plentiful, especially after the year 1940. By 1943 they had become abundant. At this time many requests were sent by farmers to the provincial game branch to have a bounty placed on foxes. Periodical cyclic abundance continues. The species is now classed as a predator under the Predator Control Act.

KIT FOX *Vulpes velox hebes* Merriam. In early times ranged the grasslands of the southwest from Pembina Hills to the Souris Plains. It had already become extinct in that region early in the century, if not before (Seton, 1909).

WISCONSIN GRAY FOX *Urocyon cinereoargenteus ocythous* Bangs. The first authentic record of this fox in Manitoba was only recently established. Sutton (1958) recounts that on January 12, 1957, Mr. Marcel Bouchard of St. Adolphe, Manitoba, trapped a gray fox, the pelt and skull of which was obtained some time later by the Manitoba Museum. It was an old male. Subspecific determination was through the courtesy of Dr. A. W. Cameron, National Museum of Canada, and Dr. C. P. Lyman, Museum of Comparative Zoology, Harvard University. Mr. Sutton stated further that "A careful check with local fur buyers reveals but one other probable occurrence in Manitoba. Mr. A. Suchrov, buyer for S. I. Robinson Company, recalls handling a single pelt taken at Sprague in 1946 or 1947."

AMERICAN BLACK BEAR *Euractos americanus* Pallas. Still fairly numerous to very common, locally, in the greater wilderness areas from Sandilands and Whiteshell forest reserves north and northwest to the Hudsonian Zone. It is equally at home in the mixed-wood forest of the lowlands and those of Riding, Duck and Porcupine mountains. Occasional strays wander into the upper areas of the parklands.

BIG PLAINS GRIZZLY BEAR *Ursus horribilis horribilis* Ord. Formerly roamed the plains of southwestern Manitoba as well as the wilds of Turtle Mountain and Brandon, Tiger and Pembina hills. It appears to have become extinct in that part of its primitive range about 150 years ago, although there may have been somewhat later rare occurrences. The Manitoba Museum has an old unearthed skull from Austin, Manitoba.

EASTERN ARCTIC POLAR BEAR *Thalarctos maritimus maritimus* (Phipps) (Figure 22). Occurs, or did occur, regularly throughout the length of the provincial coastline at Hudson Bay and as far south as Severn River, Ontario. Many years ago a few were reported from James Bay. The species more commonly resorts to the coast north of Cape Churchill, where it is still often seen. In fact, many individuals boldly visit the Churchill townsite during the night, causing some trouble and inconvenience. No effective means has been found to keep them away; only the Eskimos have the right to hunt and kill them for food and clothing.

UPPER MISSISSIPPI VALLEY RACCOON *Procyon lotor hirtus* Nelson and Goldman. At one time fairly common in southern Manitoba, ranging from southeastern localities west to Pembina Hills and Turtle Mountain

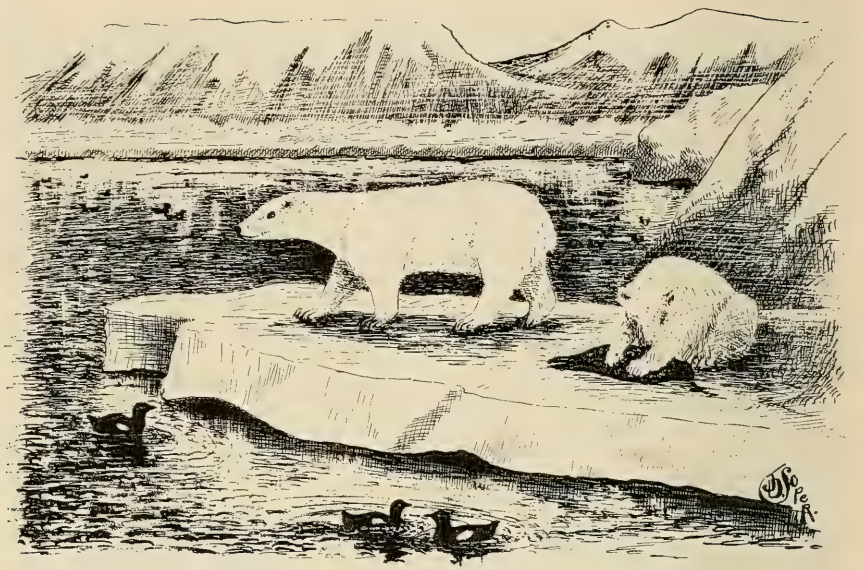

FIGURE 22. Eastern arctic polar bear hunting seal on ice floes, early summer.

and north to Riding Mountain. Early in the century raccoons had become very rare; Seton (1909) then stated that they were confined to the banks of streams in southwestern areas. Fair numbers still inhabited Turtle Mountain in 1927. During the past 10 years they have markedly increased and in some localities have become a pest. The Manitoba Game Branch records 216 having been taken in the season of 1957-58; probably many more were killed that were not recorded. On Riding Mountain the species seems to have disappeared about 1920.

HUDSON BAY MARTEN *Martes americanus abieticola* (Preble). An inhabitant of the boreal forest north to the Hudsonian Zone. In some of the remoter areas it occurs sparingly, but has diminished steadily in modern times. Throughout the southern part of its range it is now consistently rare, or completely wiped out because of overtrapping during the past century. Nevertheless, from 100 to 200 pelts are still taken annually by professional trappers.

FISHER *Martes pennanti pennanti* (Erxleben). Formerly ranged throughout the coniferous forest from the extreme southeast, north and northwest to the Hudsonian Zone. For a long time the species has been scarce even in the wilder districts and totally wanting in some parts of the primitive range, especially in southern tracts of the Canadian Zone. The yearly harvest varies from about 300 to 500 pelts.

RICHARDSON WEASEL *Mustela erminea richardsonii* Bonaparte. Distributed throughout the evergreen forests of all districts north to about the limit of trees. Along the southern border of the Canadian Zone it gradually intergrades with *bangsi*. The animals fluctuate in abundance. They had become common in the winter of 1943-44. At such times large numbers are trapped for the fur trade. Four specimens taken at Lake Dauphin and Audy and Whitewater lakes, Riding Mountain, average 317.7, 91, 42.7 (302, 84, 41—325, 95, 44) mm; 140.8 (129.1—158.2) grams.

MINNESOTA SHORT-TAILED WEASEL *Mustela erminea bangsi* Hall. Occupies the Transition parklands and brushy prairies of the south from east of Red River west to about the Souris Plains. Evidently few scientific specimens are in existence. There are de-

finite records for Winnipeg, Delta and Aweme. Tracks that may have been those of *bangsi* were seen in the snow near Pine Ridge, Carman, Stony Mountain and Libau. Probably intergrades with *M. e. cicognanii* in the extreme southeast near Lake of the Woods.

LEAST WEASEL *Mustela rixosa rixosa* (Bangs). Little is known about this diminutive carnivore in Manitoba, but it apparently ranges widely, if sparingly, in nearly all wooded parts of the province. In some areas it appears to be more numerous than formerly supposed, but it is still relatively rare. Specimens are only very slowly added to scientific collections. In the Flin Flon district Bryenton stated (Rand, 1948) that he trapped, on an average, no more than about one *rixosa* to every 100 Richardson weasels.

In the southwestern grasslands the least weasel resorts to wooded stream valleys and ravines where it hunts assiduously for members of the mouse tribe and possibly immature ground squirrels. Farmers occasionally see them under stooks, the animals doubtless being attracted there by plentiful mice and voles.

Four specimens from Carman, Delta, Big Grass Marsh and Treesbank average 187, 34.5, 22.5 (167, 27, 19.1—230, 45, 30.5) mm; wt. 40.9 (23.3—64.9) grams. There are also reliable reports of occurrences for Aweme; Riding Mountain; Gypsumville; Lake St. Martin; Elm Point, Lake Manitoba; Caddy Lake; The Pas; York Factory and Churchill.

LONG-TAILED PRAIRIE WEASEL *Mustela frenata longicauda* Bonaparte. Widely destributed on the Great Plains in the Transition Zone and farther south. Formerly common in southern Manitoba wherever true campestrian conditions prevailed. Height of abundance was reached in the southwest which provided the most suitable habitat. It is still not uncommon in some districts. Although most are found on the treeless prairies and semiarid plains, the species also roams in the adjacent parklands and lower confines of the mixed-wood forest.

Three specimens taken at Winnipeg and Max and William lakes, Turtle Mountain, average 456.7, 160.7, 53.7 (425, 139, 51—480, 173, 57) mm; wt. 382.7 (368.5—396.9) grams. *Longicauda* has been recorded also, at Morden, Portage la Prairie, Delta, Carman, Carberry, Aweme, Pipestone and the southern portion of Riding Mountain. There is some possibility that the Minnesota long-tailed weasel (*M. f. spadix* Bangs) may reach the southern corner of the province east of Red River.

HUDSON BAY MINK *Mustela vison lacustris* (Preble). This is the common dark mink of the northern forest. Its principal range almost coincides with the Canadian Zone, but to some extent it also inhabits Transition parklands and the Hudsonian Zone, thus occurring in most parts of the province. The animals continue to be fairly common, to plentiful, in various parts of the range and locally abundant where trapping pressure is less pronounced or absent.

In southern Manitoba they have been personally observed, or collected, at Whiteshell Forest Reserve; Netley Marsh, Lake Winnipeg; Assiniboine River; Douglas Lake; Turtle, Riding and Duck mountains; Overflowing River; and Summerberry Reserve near The Pas. Four specimens taken at Whitewater Lake, Riding Mountain in early October, 1946, average 550, 178.2, 61.3 (522, 167, 58—577, 188, 66) mm; wt. 1.90 (1.5—2.0) lbs. The 1957-58 harvest was 37,854 pelts (a long-time record); average take for the past 29 years, 19,255 pelts.

WOLVERINE *Gulo luscus luscus* (Linnaeus). In earlier times, generally distributed in the boreal forest north to the Arctic tundra. By the latter part of the last century it had become exceedingly rare except in the higher latitudes. Now in most parts of southern Manitoba the species has completely disappeared. In the forties a few were said to still exist northeast of Lake Winnipeg and north of Nelson River. At present it is probably most numerous in the Hudsonian and Arctic zones. The annual catch is still between 30 and 40 individuals.

AMERICAN BADGER *Taxidea taxus taxus* (Schreber) (Figure 23). A typical resident of treeless plains, prairies and the more open parklands. In earlier days it inhabited all of the campestrian region in the south; optimum conditions were reached in southwestern localities. By the end of the last century numbers had been appreciably reduced by the inroads of settlement, but the species continued fairly common until about 1925. Greatly increased value of pelts then caused marked decline in the population; however, of late years the animals have been increasing in numbers. The Manitoba

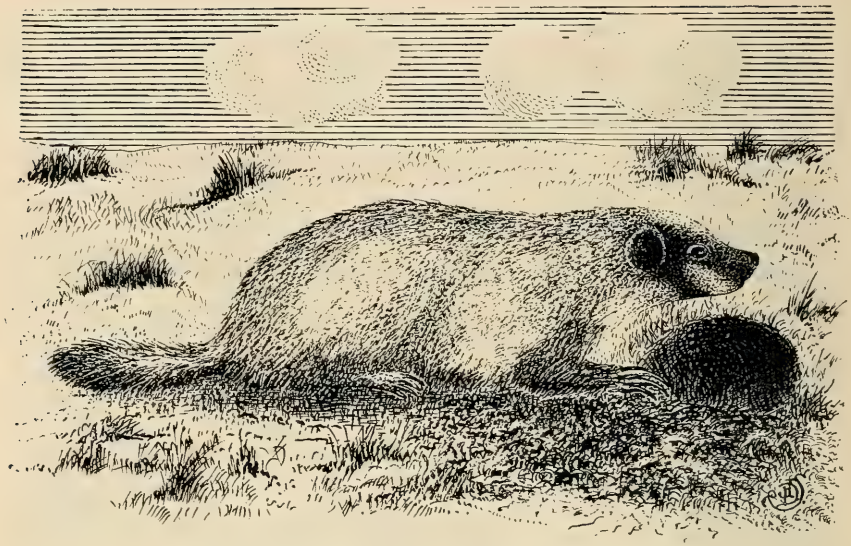

FIGURE 23. American badger at mouth of den.

Museum has specimens taken from a den at Duck Mountain, evidently the most northerly occurrence recorded for the province.

NORTHEASTERN STRIPED SKUNK *Mephitis mephitis mephitis* (Schreber). This geographical race inhabits the entire eastern part of the province from Lake of the Woods north to about the latitude of Oxford Lake. It is abundant in some southern districts, and except for localized areas it becomes increasingly scarcer to the north. It is, or was, locally common in the vicinity of Lake Winnipeg and north to about Norway House. More specimens are needed to clarify the territory of intergradation with *hudsonica,* which occupies a vast region to the west and northwest.

NORTHERN PLAINS SKUNK *Mephitis mephitis hudsonica* Richardson. Westward from about Lake Winnipeg it ranges over most of the southern two-thirds of the province in both Transition and Canadian zones. The animals may be locally common in either, but are most abundant in the parklands and lower fringes of the mixed-wood forest to the north. They are definitely more common in the southern aspen-oak grove belt, on first and second prairie steppes, than farther north and west. In addition to parklands-prairie country, proper, skunks were found notably plentiful on Turtle Mountain and fairly well represented in parts of Riding and Duck mountains.

EASTERN CANADA OTTER *Lutra canadensis canadensis* (Schreber). In early times otters were generally distributed along the waterways of the Canadian Zone, but by the early part of the present century, if not sooner, they had become very scarce, or locally exterminated. As Seton (1909) remarked: "Found all along the rivers, but exceedingly rare now." Reduction in numbers was especially marked in southeastern districts in more or less close proximity to the increasing expansion of settlement. The normal habitat of otters is heavily forested wilderness areas well supplied with streams, lakes and fish.

From a wide range in Eastern Canada this race appears to reach its western limit in east-central and perhaps more southeastern parts of Manitoba. There is some chance that *canadensis* grades into *L. c. interior* within the Whiteshell Forest Reserve and Lake of the Woods districts, since the latter subspecies is found at Elk River, Minnesota. Anderson (1946) says: "There are no

Canadian records of *interior*, but if there are any native otters or skeletal remains from the scantily wooded waters on the southern border of the Prairie Provinces their identity and possible relation to *L. c. interior* are worth investigation."

MACKENZIE OTTER *Lutra canadensis preblei* Goldman. In regard to the over-all provincial population much the same remarks apply here as appear under *L. c. canadensis*. On the whole, perhaps, the northern animals have not suffered such an incisive decline in numbers, but as almost everywhere else across the continent, otters have greatly diminished in abundance as compared with primitive times. The present subspecies occurs over the greater part of northern Manitoba south of the treeline; its range extends eastward to Hudson Bay north of the territory occupied by *canadensis*. The animal has been reported as sometimes ranging along Arctic streams north of the limit of trees (Harper, 1956). Concerning the subspecific status of east-central Manitoba otters, Anderson (1946) says that, "Goldman (1935, Proc. Biol. Soc. Wash., vol. 48, p. 179) states that 29 specimens from central Manitoba (Cross Lake, Oxford House, and Norway House) grade toward typical *L. c. canadensis*, but in size are more properly referable to *L. c. preblei*."

ROCKY MOUNTAIN COUGAR *Felis concolor missoulensis* Goldman. Of occasional occurrence in southern localities. Seton (1925, Vol. 1, p. 49-50) listed the following places where cougars had been reported: Makinak, Riding Mountain, Plum Coulee, Brandon, Elphinstone, and Oak and Swan lakes. V. W. Jackson recorded in the *Winnipeg Tribune*, February 14, 1942, that one was seen a few days earlier near Marquette; the article also mentioned that "a Mr. Mackenzie, cabinkeeper at West Hawk Lake saw what looked like a mountain lion cross the highway on February 9. . . . Twenty years ago a mountain lion attacked a boy and girl at Birtle, Manitoba, killing the latter. When shot it was found to be blind and half starved." Norris-Elye (1951) stated that since about 1921 he had come into possession of several sight

FIGURE 24. Canada lynx in an Indian trap set.

FIGURE 25. Ventral view of Atlantic walrus head, showing long ivory tusks.

records within the province; the more definite of these derived from the following localities: northerly foot of Turtle Mountains; Carman; nine miles northwest of Morris; and Sprague. Mr. R. Sutton informed me that of late years there have been reliable records of occurrence at Riding Mountain; Whiteshell Forest Reserve; and in the vicinity of Manigotagan River.

CANADA LYNX *Lynx canadensis canadensis* Kerr (Figure 24). In earlier days, commonly inhabited all mixed-wood forest north to the limit of trees at the Arctic tundra. Although essentially an inhabitant of the boreal forest, it also roamed to some extent in the parklands, sometimes well south of its normal environment. The lynx is now very rare, or exterminated, in extensive areas of the south. During peak years of cyclic abundance the animals are still fairly numerous over wide tracts of the northern wilderness, but in the 1940's only rare stragglers remained on Riding and Duck mountains. The provincial catch averages about 500 annually.

EASTERN BOBCAT *Lynx rufus rufus* (Schreber). Evidently it is this form of bobcat that occurs and has lately become commoner in southeastern Manitoba. Seton (1925, Vol. 1) referred to occurrences at La Riviere and Pembina. In a letter of March 30, 1951, the late Mr. Norris-Elye, Director of the Manitoba Museum, stated that a bobcat had been trapped recently near Mud Lake, in extreme southeastern Manitoba, and another near Steinbach about the same time; for further, detailed information see Norris-Elye (1951). Mr. R. Sutton has informed me that the Manitoba Museum has a bobcat kitten taken a couple of years ago near Fort Whyte.

Order PINNIPEDIA. Walrus and Seals

ATLANTIC WALRUS *Odobenus rosmarus rosmarus* (Linnaeus) (Figure 25). This huge, ungainly creature has apparently never been common along the coast of Manitoba, probably because of the character of that seaboard, tidal and otherwise. Among other factors, suitable breeding islands are a critical necessity and such are conspicuously lacking in the area under review. Nevertheless, a few animals sometimes ranged down the coast as far south as Cape Henrietta Maria. The

nearest centers of abundance existed in the Belcher Islands and in Roes Welcome. Individuals and small groups that casually appeared off the coast from Port Nelson to Chesterfield Inlet presumably bred in the latter area.

ATLANTIC HARBOR SEAL *Phoca vitulina concolor* (De Kay). Occurs locally all along the provincial coastline at Hudson Bay. It is more often found in the mouths of streams discharging into salt water, such as the Hayes, Nelson, Churchill and Seal rivers. Sometimes they swim several miles up such larger streams. Harbor seals also occasionally inhabit fresh-water lakes that are connected by river with the sea; one example is that of Nueltin Lake (Harper, 1956). While widely distributed in Hudson Bay and the Eastern Arctic Achipelago, these seals are usually thinly dispersed, or rare, north of about latitude 60°.

ARCTIC RINGED SEAL *Phoca hispida hispida* Schreber (Figures 26 and 27*A*). Generally distributed in the northern part of Hudson Bay and south along the Manitoba coast to at least York Factory. Formerly occurred abundantly from Port Churchill, northwards, and apparently continues to be the common seal of those waters. In more northern latitudes it is the most prominent member of the Pinnipedia and in many localities reaches a state of abundance. The species was a mainstay in the economy of the primitive Eskimos who used it for food, fuel (blubber), summer clothing, lines and tupeks or summer tents.

GREENLAND OR HARP SEAL *Pagophilus groenlandica* (Erxleben) (Figure 27, *B* and C). This species is only of casual occurrence along the Manitoba seaboard and apparently this is true of all the west coast of Hudson Bay. It has been recorded intermittently at various places from Churchill north to Roes Welcome and rarely in more northern polar waters to southern Ellesmere Island. Its center of abundance is in neither Hudson Bay nor Strait, but in the North Atlantic and along the Labrador coast from Belle Isle to Cape Chidley.

FIGURE 26. Young 'white-coat' ringed seal in birth chamber under the snow, over the sea ice; diving hole in the foreground.

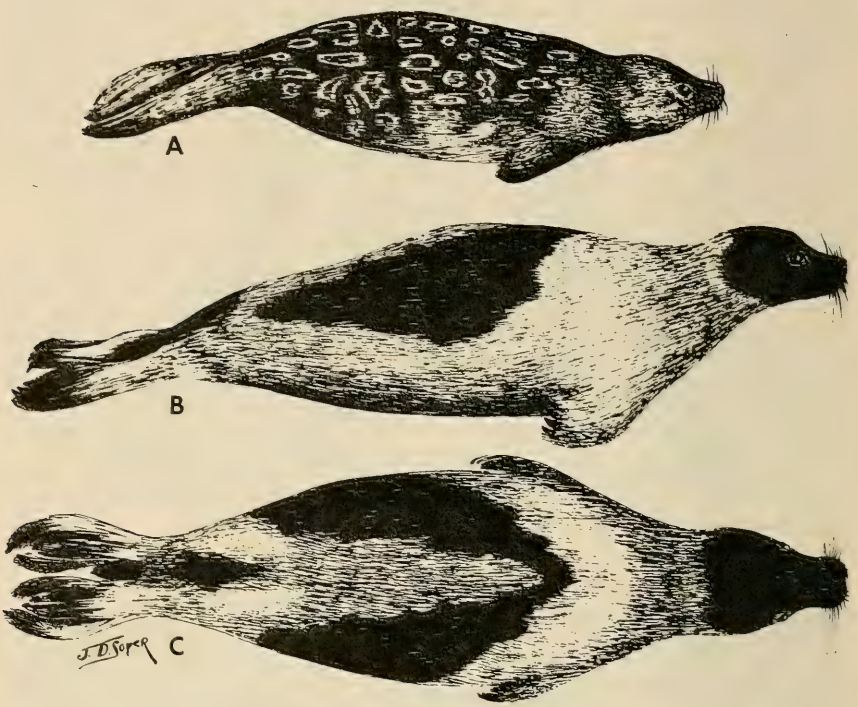

FIGURE 27. *A*, Arctic ringed seal; *B* and *C*, side and dorsal views of Greenland or harp seal.

BEARDED SEAL *Erignathus barbatus barbatus* (Erxleben) (Figure 28). Occurs, or did occur, with fair regularity all along the west coast of Hudson Bay. Many have been killed in the vicinity of York Factory, Fort Nelson and Churchill. The species is locally more numerous to the north. In some Arctic localities it is fairly common, or even plentiful, but, at best, it has never been as abundant as the ringed seal. The bearded seal (ukjuk) is of great importance to the Eskimos, not only because of the superior bulk of meat and blubber provided, but also on account of the greater thickness and strength of the hide. The hide was of great merit in the making of strong lines, dog traces, waterproof boots (kummiks) and other necessities.

Order ARTIODACTYLA. Hoofed Animals

MANITOBA WAPITI *Cervus canadensis manitobensis* Millais. In the early days, occurred abundantly in southwestern Manitoba from Red River and Pembina Hills west in both prairies and parklands, on Turtle Mountain, and, north, in the forests of Riding and Duck mountains. By 1884 it was nearly exterminated except in Pembina Hills (Seton, 1909a). Criddle (1929) stated that in the Treesbank—Spruce Woods district the animals were fairly common until 1887, after which they soon became locally extirpated.

In due course, protective laws saved the more northern remnants from complete extermination. Most of the several thousand wapiti now existing in Manitoba, roam the

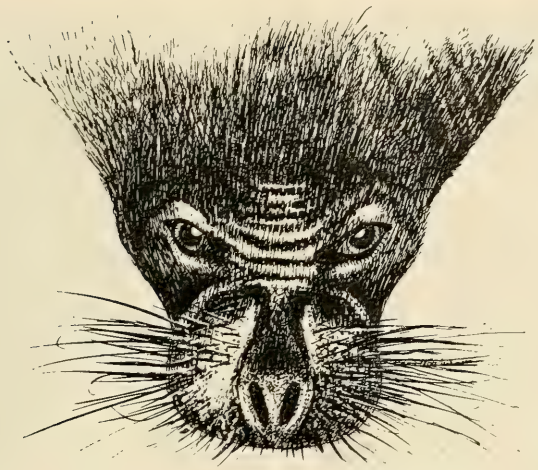

FIGURE 28. Front view of bearded seal head.

wilds of Riding Mountain National Park Banfield, 1949; Soper, 1952) and Duck Mountain. A small residiual population also occurs in the interlake country, now chiefly centered in the Mantagao Lake area and northwest of Gypsumville toward Waterhen Lake.

ROCKY MOUNTAIN MULE DEER *Odocoileus hemionus hemionus* (Rafinesque) (Figure 29). Before the days of settlement this was the common deer in southern Manitoba. It was generously distributed more or less throughout the prairie-parklands districts and north for some little distance into the mixed-wood forest. Preference was shown for the second prairie steppe west of Red River.

Since the early 1920's, mule deer have become steadily scarcer. In many districts they have slowly disappeared with the gradual infiltration of white-tailed deer. This process of displacement continues. Relatively few *hemionus* now remain in the settled parts of the south. About five years ago a herd of 14 individuals was seen in Spruce Woods Reserve when the Game Branch made an aerial census of deer. The most recent known kill was made in that reserve during the fall hunting season of 1958. The few remaining animals appear to frequent the eastern slope of the sandhills toward the flats of Assiniboine River.

Scattered individuals and pairs still exist on Riding and Duck mountains; these are residual from times when they were the common and dominant deer of the region. Elsewhere, north of the parklands, a few widely dispersed individuals and small bands may still exist. At one time mule deer were seen as far north as The Pas and Flin Flon, but Harold Wells, who is familiar with the former area, says that none has been taken there during the past 35 years.

NORTHERN WHITE-TAILED DEER *Odocoileus virginianus borealis* Miller. According to Seton (1909; 1909a) these animals (presumably of this race) spread into Manitoba about 1881, more or less coinciding with the early settlement of the country. Thereafter they increased rather rapidly and spread over wider areas. For Manitoba, Anderson (1946) assigned *borealis* only to eastern districts; it is commonly distributed from the International Boundary north through Sandilands and Whiteshell forest reserves to at least Winnipeg River.

In earlier times, it was either this form, or *dacotensis*, which also spread north along Red River Valley, and the brushy bottomlands of Pembina River, to the rugged terrain of Pembina Hills. In presettlement days and a little later, the latter territory was renowned for its big game resources, including moose and wapiti. Present western and northern limits of *borealis* range are not accurately defined.

FIGURE 29. Mule deer on a pine-forested ridge.

PLAINS WHITE-TAILED DEER *Odocoileus virginianus dacotensis* Goldman and Kellogg. Little is known about the past history of this race in Manitoba. However, it was clearly an early resident of wooded valleys in the dry plains of the southwest and on Turtle Mountain. Now it is the common deer in that area and east to Pembina Hills. It has almost entirely usurped the former range of the mule deer in Manitoba.

White-tails have continued to increase in numbers and expand their range, especially during the last decade. Many occur in the interlake district as far as Waterhen Lake and lower Lake Winnipegosis. In some areas the animals are abundant. For example, while traveling by rail to the west on April 4, 1948, I counted 122 of these deer between the sandhills northwest of Brandon and the vicinity of Rivers, a distance of 18 or 20 miles. Perhaps many more were hidden in the scattered poplar bluffs.

West of the central great lakes the animals are familiar residents of brushy lowlands, Riding and Duck mountains, and territory about Swan River. They now greatly outnumber mule deer in all of that area. Numbers have been reported to the north well beyond The Pas. This deer is assumed to be the present race that resides, throughout, since it inhabits Riding Mountain (Anderson, 1946) and all adjoining areas in Saskatchewan, and west.

In a recent communication Mr. Malaher remarks: "In the northern parts of its range it is not common, but it does occur as far north as Pukatawagan on the Churchill River. A line drawn from there southeastward to the Central Manitoba Mining District would roughly indicate the northern limit of range, although isolated animals would be found north and east of such a line. In certain years it has been quite plentiful in The Pas district, particularly on the flood plains and delta of Saskatchewan River. A severe winter in this latitude, however, seems to set it back very materially."

In the white-tail range as described above, individuals inhabiting the more eastern territory may possibly be assignable to *borealis*, as they are, farther south, along the Manitoba-Ontario boundary.

NORTHWESTERN MOOSE *Alces alces andersoni* Peterson. This new subspecies (Peterson, 1952, p. 24-27) is the moose that ranges throughout the northern coniferous forest of Manitoba. Formerly it also inhabited parts of the northern parklands, timbered fringes of Red River, Pembina Hills, Spruce Woods (near Carberry) and the Turtle Mountain plateau. The animals were evidently never as abundant in the far northern parts of their range as in more moderate latitudes farther south.

Settlement has naturally caused marked changes in distribution and status in the latter region. In more northern districts, however, moose continue to be moderately common, to abundant. As Mr. Malaher remarks (letter, Feb. 13, 1959): "It has made a tremendous come-back in the recent past. We now have all of northern Manitoba open to moose hunting with two seasons in some areas, and, in all, there are six moose hunting areas in the province. Regulations have been liberalized to permit the taking of either sex. We are still under-harvesting our moose. Within the past month, flying down the east side of Lake Winnipegosis, I counted 17 moose before we reached the north end of Waterhen Lake. We were on a direct flight from The Pas to Selkirk and not especially looking for moose.

"Today there are still over 1,000 moose in the Saskatchewan River Delta east of The Pas.... For the past three seasons we have had a moose-elk season on Duck Mountain and have taken over 1,000 moose from this area alone. Aerial surveys indicate no decrease in the population level."

BARREN GROUND CARIBOU *Rangifer arcticus arcticus* (Richardson) (Figure 30). These animals undertake periodic winter migrations as far south as central parts of the province. Although a denizen of the Arctic tundras most of the year during the colder months, it habitually wanders south to seek food and shelter in woods and muskegs of Hudsonian and Canadian zones. At this season the normal southern limits of these treks are approximately bounded by Churchill River and an imaginary line running from Southern Indian Lake to Reindeer Lake.

In the bitter winter of 1939-40, however, unusually large numbers of these caribou migrated south to the vicinity of Burntwood River and Nelson House, about 300 miles south of the Northwest Territories (Can. Resour. Bull. 155, March 1940). Another heavy migration overran this area in the winter of 1944-45 (Rand, 1948). Several times since then, winter herds have struck south to the Hudson Bay Railway, some little distance northeast of The Pas. Once they actually went as far as Gods Lake and the vicinity of Cross Lake and Oxford House before receding again, toward spring, in the direction of the Arctic summer range. On this occasion, some Indians who were over 40 years old, and had never before seen this species, shot barren ground caribou at these places.

These caribou once occurred in prolific abundance. Within the past few decades, however, they have been steadily dwindling (Banfield, 1954). The trend now has an alarming aspect; for some reason or reasons, the situation has deteriorated much more rapidly of recent years and there is anxiety about their ultimate fate. At the present rate of decline there would appear to be serious danger of *arcticus* vanishing completely, not only in Manitoba, but throughout its Arctic and subArctic range.

WESTERN WOODLAND CARIBOU *Rangifer caribou sylvestris* (Richardson). Over-all provincial range embraces the coniferous forest from Lake of the Woods northward to about Churchill River. In the east the species ranges to the coast of Hudson Bay and north to Cape Churchill, and in the west-central region, south to Porcupine Mountain. In early times it doubtless inhabited the heights of both Duck and Riding mountains, since, in this longitude, woodland caribou once occurred even as far south as Turtle Mountain (Bailey, 1926, p. 33).

Major occurrence, today, is in a belt of country extending from Sherridon, in the west, southeastward to about the acute angle of the Manitoba-Ontario boundary near Elliot Lake. In recent times, *sylvestris* gradually became scarcer until the question of its survival in Manitoba was in doubt. This has been dispelled, however, by the good news that it is now slowly increasing in numbers. The largest known herd is northeast of Berens River, in the Hudwin Lake district, which is estimated to contain between 4,000 and 5,000 individuals.

FIGURE 30. Head of barren ground caribou with antlers in the 'velvet'; month of August.

AMERICAN PRONGHORN ANTELOPE *Antilocapra americana americana* (Ord). Formerly existed widely and plentifully over the grasslands of south-central and southwestern Manitoba. A few rarely went as far east as the Red River lowlands, and apparently north to the vicinity of old Fort Garry. Center of abundance lay on the second prairie steppe, north to about Assiniboine River, the heaviest concentrations being on the Souris Plains. In some localities limited numbers foraged north of the Assiniboine, at least in the general vicinity of Pine Creek and Minnedosa River (Little Saskatchewan) and northwest to about the latitude of Qu'Appelle River.

In the eastern part of the range the species had all but vanished by the 1850's. A few wary bands held out for about another 15 to 20 years in more rugged terrain between Pembina and Tiger Hills. The last Manitoba stronghold lay in the extreme southwest around Whitewater Lake, Melita and Coulter, where the last survivors were apparently wiped out in 1881.

PLAINS BISON *Bison bison bison* (Linnaeus). In early times these lordly beasts provided the greatest wildlife spectacles of the 'Old West.' Gathered in various-sized herds, they roamed the plains in astonishing numbers. At least a few infiltrated the mixed-wood forest as far north as Moose Lake. But they were destined to take the road to oblivion. Seton (1909) remarked: "Formerly found in great abundance on all the prairies of Manitoba. Last seen wild near Winnipeg in 1819. Last great wild herd on the Souris 1867; the last wild individual on the Souris 1883." A moderate-sized herd is now preserved in a fenced enclosure on the Lake Audy Prairie, Riding Mountain National Park.

BARREN GROUNDS MUSKOX *Ovibos moschatus moschatus* (Zimmermann). Type locality: between Seal and Churchill rivers, Manitoba. The species formerly inhabited the restricted, open, tundra area along the Hudson Bay coast in what is now the northeastern extremity of the province. Preble (1902) recorded the occurrence of two examples, during the summer of 1897, about midway between York Factory and the mouth of Churchill River; this is evidently the most southern authentic record extant for the region. In this tundra triangle of Manitoba's Arctic Zone, the muskox is now extinct. Apparently the nearest living representitives are several hundred miles distant to the north and northwest.

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FAITH FYLES

Artist-Naturalist

1875-1961

Faith Fyles, born at Cowansville, Quebec, died at Ottawa, October 22, 1961. Her father, Dr. T. W. Fyles was an Anglican clergyman, a member of this club and a contributor to the *Ottawa Naturalist.*

In the spring of 1911, Miss Fyles (B.A., McGill) became sole professional assistant to the recently appointed Dominion Botanist, H. J. Güssow. She succeeded Herbert Groh, who had returned to farming; and in 1922, when she transferred to the Division of Horticulture she was succeeded by Herbert Groh, who had come back to the Civil Service.

Miss Fyles joined the Club in 1912 and served on Council from 1914 to 1931, her chief activity being as Leader in Botany and as a member of the Excursions and Lectures Committee. In 1915 she donated a prize of $5.00 for the best collection of 50 native species of deciduous trees and shrubs showing reproductive, vegetative, and dormant stages. In this way she gave needed encouragement to local natural history.

Her appreciation of nature and its beauties is charmingly expressed in her article "A Swamp," which appeared in the *Ottawa Naturalist* in 1912. Her studies of wild rice are also noticed, but probably her most important publication was the government bulletin "Principal Poisonous Plants of Canada", which appeared in 1920. This booklet is illustrated profusely with sketches, photographs, and paintings by the author. The originals of these illustrations are now carefully preserved in the Plant Research Institute of the Canada Department of Agriculture.

In the Division of Horticulture her role of botanical artist under Dominion Horticulturists W. T. Macoun and Malcolm Davis occupied an important place. Her facile paintings showing colors and forms of new fruits and flowers preceded the use of color photography for record purposes and it occurs to the writer that they are a more accurate and more permanent medium. Another activity was the establishment of a horticultural herbarium.

Both before and after her retirement, Miss Fyles devoted herself to art. She studied in Paris, under Stanhope Forbes in England, and under Franklin Brownell in Ottawa, and also made study trips to Spain and Italy. Several exhibitions of her art were held in Ottawa. They comprised oils, pastels, and water colors showing scenes in France, Jamaica, Florida, New York, Alberta, and British Columbia, but with them were her beloved delphiniums, peonies, lilacs, zinnias, and marigolds.

For assistance in preparing this brief sketch my sincere thanks go to Mrs. L. F. Crothers of Ottawa, a niece; Mr. Malcolm Davis, retired Dominion Horticulturist; many officers and former officers of the Department of Agriculture, and particularly to Herbert Groh.

Hoyes Lloyd

NOTES ON THE DISTRIBUTION AND RELATIVE ABUNDANCE OF FRESH-WATER FISH IN UNGAVA

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THE FOLLOWING is a summary of observations made in Ungava in recent years by the authors.

In 1955 both authors spent four and a half months conducting limnological investigations in the vicinity of Lake Aigneau. (See Figure 1 for this and most other locations mentioned in the text.) In 1956 Power spent three months at Helen Falls collecting data on the Atlantic salmon inhabiting the George River. The following year the salmon investigations were continued on the Koksoak River when Power traveled the length of the Koksoak and also a short distance up its two major tributaries, the Larch and Kaniapiskau rivers. During the same year, 1957, Oliver carried out a limnological survey of Astray Lake and visited briefly other lakes in the Schefferville area. During the summer of 1960 Power, assisted by G. M. Telford, collected data on fish inhabiting the lower reaches of the Whale River. Although the primary aim of these investigations was not to collect information on distribution and abundance of fresh-water fish, enough data has been accumulated to warrant recording.

Localities mentioned are all south of the tree line. The area forms part of the Laurentian plateau, which in the center of the Labrador plateau has an average height of under 2000 feet. The lakes of this region are mostly shallow; shorelines are of rock and sand. The water is clear. Secchi disc readings are usually greater than 4 meters. Streams and rivers are fast flowing and have beds of rock, boulders, pebbles or sand. Spring breakup occurs in May or early June and the rivers and lakes are free of ice for about six and a half months. Water temperatures during the summer reach a maximum of 15-16°C in the rivers; surface temperatures of lakes are generally a few degrees less. Drainage of the George River, Whale River, and Koksoak River system, which includes Foggy Lake, Hannas Lake and Knob Lake, is northwards into Ungava Bay. Astray Lake drains eastwards via Dyke Lake into the Ashuanipi River and finally the Hamilton River.

Methods of sampling the fish fauna varied from location to location. During the limnological surveys gangs of gill nets ranging in size from 1½ to 5½ inches per stretched mesh were employed and catches supplemented by use of minnow traps and dip nets and by angling. For the salmon investigations the gill nets were of 1½-, 4-, 6- and 8-inch mesh, and in addition a 1½-inch, 4-foot hoop, fyke net, dip nets, and angling were used. Rotenone was used to make some of the collections at Whale River.

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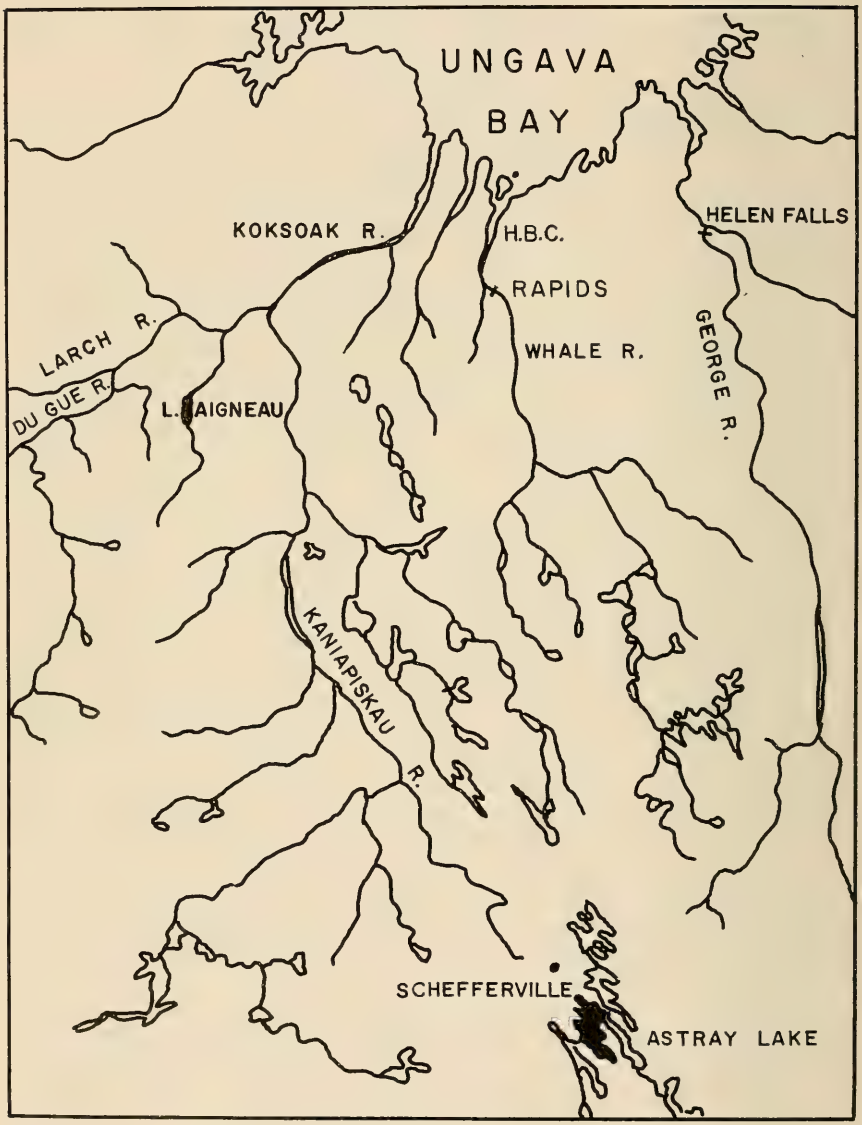

FIGURE 1. Map showing locations where field work was carried out. Hannas Lake, Foggy Lake and Knob Lake, not shown on the map, are small lakes in the vicinity of Schefferville.

TABLE 1. OCCURRENCE AND RELATIVE ABUNDANCE OF FRESH-WATER FISH IN UNGAVA

Species \ Location	Helen Falls on George R. 58°09′N 64°50′W	Lake Aigneau 57°14′N 70°07′W	Tributary of R. DuGue 57°16′N 70°37′W	Lower 12 miles of Larch and Kaniapiskau R.	Koksoak River, except estuary	Astray Lake 54°35′N 66°31′W	Hannas Lake 54°49′N 66°42′W	Foggy Lake 55°03′N 67°15′W	Knob Lake 54°48′N 66°48′W	Whale River, first rapids above tidal water	Whale River, old H.B.C. post, tidal water	Small lake near Whale R. 57°55′N 67°39′W
Coregonus clupeaformis	C			C	C	A			P	C	C	
Prosopium cylindraceum	A			C	C	C				C		A
Salmo salar	A		A	A	A					A	A	
Salmo salar ouananiche		S				C						
Salvelinus alpinus	S	C		S	S						C	
Salvelinus fontinalis	A	A	A	A	A	C			P	A	A	
Salvelinus namaycush	C			C	C	A				S		A
Catostomus catostomus	C	A		C	C	A			P	C		A
Catostomus commersonni	S											
Hybopsis plubea	P	P	P			P	P	P		P		P
Rhinichthys cataractae		P	P							P		
Esox lucius	S	A				C	P			S		
Cottus cognatus	P				P					P	P	
Cottus bairdi	P	P		P	P	P	P			P	P	
Gasterosteus aculeatus		A		P	P	P				P		P
Lota lota		S		S	P	C				P		
Pungitius pungitius										P		

A—abundant C—common S—scarce P—present

Two marine species, *Myoxocephalus scorpius* and *Ammodytes dubius*, were taken in tidal pools near the old H.B.C. posts, Whale River.

Table 1 summarizes the data obtained. For the purpose of indicating the abundance of a species at each locality the following code has been adopted:

A, abundant; the species is numerous and makes up at least 10 percent of the net catch.

C, common; the species froms 1-10 percent of the total in every net catch.

S, scarce; the species forms less than 1 percent of all catches.

In a fourth category, P, (present), no attempt to express abundance has been made. The fish are not normally taken in gill nets and abundance is difficult to estimate.

Seventeen species of fresh-water fish were collected from one or more of the localities visited. Four species, the brook trout (*Salvelinus fontinalis*), the longnose sucker (*Catostomus catostomus*), the lake chub (*Hybopsis plumbea*), and the mottled sculpin (*Cottus bairdi*), although not collected in every locality have a widespread distribution south of the tree line. This is probably true also of the northern pike (*Esox lucius*,), the threespine stickleback (*Gasterosteus aculeatus*), and the burdot (*Lota lota*), but our observations do not warrant a definite assertion. There are some interesting examples of species being absent from particular regions. For example, Lake Aigneau, in the watershed of the Koksoak River, contains no whitefish (*Coregonus clupeaformis* or *Prosopium cylindraceum*) and no lake trout (*Salvelinus namaycush*), but has both landlocked salmon (*Salmo salar ouananiche*) and arctic char (*Salvelinus alpinus*). The arctic char appears to be absent from the Schefferville region, whereas landlocked salmon is common there. The longnose dace (*Rhinichthys cataractae*) has so far only been collected in the Koksoak and Whale river systems. Until much more information has been accumulated no attempt can be made to explain such discontinuities in the distribution of fresh-water fish in Ungava.

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International Code of Zoological Nomenclature

The Secretary of the International Commission on Zoological Nomenclature announces the publication in November 1961 of the new edition of the Code.

The Code, in its new guise, forms a volume of almost exactly 200 pages and consists of English and French parallel texts on facing pages, English and French Glossaries, Index, Introduction by Dr. Norman Stoll and Preface by Professor J. Chester Bradley. The price is £1.0.0 (one pound sterling) post free. Orders should be addressed to The Publication Office, The International Trust for Zoological Nomenclature, 19 Belgrave Square, London, S.W.1.

A SIGNIFICANT INCREASE IN THE BIRDS OF LUTHER MARSH, ONTARIO, FOLLOWING FRESH-WATER IMPOUNDMENT

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Luther Marsh

In many cases, the building of dams for flood control, power development and water conservation has also created better habitat for wildlife. This has been demonstrated in Wisconsin by Truax (1952) and in Tennessee by Steenis (1950). The utilization by waterfowl of artificially created marsh in New York State has been reported by Bradley and Cook (1951) and Benson and Foley (1956). Pymatuning Lake in Pennsylvania might be cited as another example (Todd, 1940).

Recent improvement in habitat for wildlife in Ontario has resulted from impoundment of the Luther Marsh by building a dam across a branch of the Grand River. In addition to serving the primary purposes of flood control and water conservation, Luther Marsh has provided new habitat for waterfowl, muskrats, fish and other wildlife. The use of this area by birds has probably given the project more publicity than has the aspect of flood control. Each autumn hundreds of hunters flock to the marsh for the duck hunt.

This paper concerns the present use of Luther Marsh by waterfowl and marsh birds. From 1952 to 1957 the junior author made eleven visits to the marsh and kept a record of the birds seen. In 1958 and 1959 more extensive investigations of the breeding-bird population were undertaken by both authors.

Location

Luther Marsh is located on a high plateau at an elevation of about 1575 feet above mean sea level, 22 miles west of Orangeville, Ontario. It lies on either side of the boundary between Wellington and Dufferin counties, and is part of the Grand River Basin. It is drained through a small watercourse known as Black Creek. The building of the dam has created a lake about five miles long and about four miles wide.

History

In early days Luther Swamp was a bog in which moss and peat occurred to a depth of about 20 feet. Drainage for agricultural purposes was begun as early as 1890. Repeated cutting removed the mature timber from the general area of the swamp until, at the time of flooding, all that remained were immature stands of elm (*Ulmus* sp.), birch (*Betula* sp.), poplar (*Populus* sp.), tamarack (*Larix laricina*) and white cedar (*Thuja occidentalis*).

For many years before the dam was built the only water areas in addition to Black Creek were Wylde Lake to the south and a small boggy lake on the

*Died 20 October 1960.

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MOSSEN

west side north of the 7th Concession Sideroad of West Luther Township. According to local residents these waters contained a small population of "big ducks," presumably Black Ducks and Mallards.

Present Size

In 1950 the Grand River Conservation Commission began acquiring the necessary land, a total area in excess of 5000 acres. Of this, 1140 acres was owned by the township of West Luther and the remainder was under private ownership. The actual flooded area (Figure 1) is about 4500 acres. The dam is 930 feet long and consists of a watertight earth embankment 15 feet high. As a safeguard against wave action the upstream face of the embankment has been riprapped. A flume of reinforced concrete, six feet wide, extends through the earthfilled section. At the center of the flume a control mechanism is provided for the placing and removal of timber stop-logs, the manual operation of which is from a small control house situated on a deck above the flume. The gross storage capacity of the marsh is approximately 10,000 acre-feet.

In 1954, the Ontario Government established the Luther Marsh Game Preserve, an area of about 800 acres in the northern portion of the marsh. This section is closed to hunting.

Previous Investigations

Very little ornithological work has been done at Luther Marsh. J. H. Day made a ten-day survey of the marsh as a waterfowl production area in 1955 and submitted a report of his findings to the Canadian Wildlife Service, Ottawa (Day, 1955). H. Gray Merriam and D. I. Gillespie (1956) conducted a three-day investigation of the waterfowl brood production for the Ontario Department of Lands and Forests and the Ontario Agricultural College, Guelph. Personnel of the Ontario Department of Lands and Forests have made annual game-bag checks on the opening day of the duck hunting season beginning in 1953.

Types of Habitat

As would be expected in an area as extensive as Luther Marsh there is wide diversity in the types of habitat represented. Day (1955) has described the general vegetative features of the area including waterfowl food and cover plants. The various habitats may be classified in order of importance as follows:

(1) Cattail (*Typha* sp.) Marsh. This is a belt of varying width found along the shores and around most of the islands. Birds nesting in this habitat were: Pied-billed Grebe, Least Bittern, American Bittern, Redhead, Ruddy Duck, American Coot, Black Tern, Long-billed Marsh Wren and Redwinged Blackbird.

(2) Leatherleaf (*Chamaedaphne calyculata*) Area. This is an extensive tract lying in the south end of the marsh consisting of a *Chamaedaphne-Sphagnum* association along with poplar, willow (*Salix* sp.), birch, tamarack, white cedar, blueberry (*Vaccinium* sp.) and bog rosemary (*Andromeda glauco-*

FIGURE 1. Aerial view of Luther Marsh. Flooded land is shown as dark areas in which the islands appear as light colored masses. The dam is visible at the upper right. Big Bay is the dark arm at the right center of the picture.

phylla). Birds found mainly in the east, west and northern sections of this area were: Least Bittern, Mallard, Black Duck, Blue-winged Teal, Ring-necked Duck and Redwinged Blackbird.

(3) Islands. There are nine islands consisting of high sections of former grassy agricultural land. Around each a belt of cattails has become established. On the islands a wide variety of plants occur. Among the woody plants are willow, sumac (*Rhus* sp.) and red-osier dogwood (*Cornus stolonifera*). Herbaceous vegetation includes vetch (*Vicia* sp.), sweet clover (*Melilotus* sp.), goldenrod (*Solidago* sp.) and daisy (*Chrysanthemum* sp.), which, with various emergent and submerged aquatics, make these islands ideal habitat for waterfowl. Near the middle of the marsh is an area of a square mile called locally the "huckleberry marsh", where a thick growth of leatherleaf occurs, also willows, goldenrod, sedges (*Carex* sp). and rushes (*Juncus* sp.). This section does not have solid ground. Birds found here were: Common Loon, Pied-billed Grebe, American Bittern, Mallard, Black Duck, Gadwall, Blue-winged Teal, Virginia Rail, Sora, Common Gallinule, American Coot, Wilson's Phalarope, Black Tern, Long-billed Marsh Wren, and Redwinged Blackbird.

(4) Meadows. This was formerly cultivated land. Among various species of grasses are weeds such as goldenrod, thistle (*Cirsium* sp.), milkweed (*Asclepias* sp.) and vetch, which show signs of becoming dominant. Birds here were: American Bittern, Mallard, Blue-winged Teal, Bobolink, Eastern Meadowlark, and Savannah Sparrow.

(5) Drowned Swamp Forest. This is a large area of dead trees: poplar, birch, tamarack, white cedar, elm, and black ash (*Fraxinus nigra*). They are in the north and west-central sections of the marsh. Birds of this region were: Great Blue Heron, Black-crowned Night Heron, Eastern Kingbird, Tree Swallow, and Common Grackle.

(6) Dry Woodland. This consists of former farm woodlots, scattered stands of mixed hardwoods, mainly of beech (*Fagus grandifolia*) and maple (*Acer* sp.). The land birds here were fairly typical of those normally associated with mixed woodlands throughout agricultural southern Ontario. They were: Yellow-shafted Flicker, Red-headed Woodpecker, Eastern Wood Pewee, Robin, Red-eyed Vireo, and Baltimore Oriole.

ANNOTATED LIST OF BIRDS

Luther Marsh supports a large population of birds. Since human interference was almost nonexistent the marsh was an ideal location for the study of bird life. Although our primary interest was ducks and marsh birds, records were kept of all species noted. Up to June 30, 1960, 113 species were recorded by us on the marsh or in its immediate environs. Breeding evidence for 35 of these was established.

Eleven species of ducks were found breeding. Common nesting species: Blue-winged Teal, Mallard, Black Duck. Regular, but not common, species: Pintail, Ruddy Duck, Ring-necked Duck. Occasional nesting species: Gadwall, Green-winged Teal, Redhead, American Widgeon, Lesser Scaup. Besides the 11 species of ducks definitely known to nest, the Shoveler in the breeding season showed definite territorial behavior and must be considered a potential nester.

Waterfowl and marsh birds recorded at Luther Marsh are given in the following pages. A few additional species breeding along the marsh borders are also included. Land birds to the number of 50, at least, inhabiting woodland territory adjacent to the marsh have not been included. Scientific

and common names are those of the fifth edition of the *Check-list of North American Birds* (American Ornithologists' Union, 1957).

COMMON LOON *Gavia immer*. An uncommon nesting bird in the marsh. It has been present each breeding season since 1955. As many as five adults were seen on August 2, 1957. Although this species was thought to breed each summer, it was not until May 30, 1958, that a nest of two eggs was found on a small island in the western part of the marsh. By June 18, the eggs had hatched and there was one chick in the nest; the other was nowhere to be seen. When Boyer placed the young loon on a paddle for a photograph, it kept crawling towards him and, when replaced in the water, tried to follow the canoe. This appeared to be an example of imprinting.

In 1959, we saw two adults with one half-grown young on July 25, and believe two pairs may have bred in the marsh.

RED-NECKED GREBE *Podiceps grisegena*. An uncommon summer resident, occasionally breeding. A single bird was noted on August 22, 1952, and three near the dam on July 21, 1959. A nest of five eggs and also an adult with a brood of three young were found by Boyer, June 22, 1960, in the "huckleberry marsh" area.

HORNED GREBE *Podiceps auritus*. A regular spring and fall migrant. As a pair was observed putting on a mating display on June 2, 1957, on the east side of the marsh, it is possible that this species may occasionally remain to nest.

PIED-BILLED GREBE *Podilymbus podiceps*. A very common summer resident and migrant.

This species showed a decided preference for the cattail marsh as nesting cover. Of 74 nests found in 1958 and 1959, approximately 90 percent were in cattail marsh at distances varying from 3 to 20 yards from the water's edge. Other nests were located in open water, sometimes near a small bush and occasionally some distance from any type of cover.

Nesting occurred from the first week in May to early August. The height of the season appeared to be during the latter half of May and early June. Clutch sizes varied from 5 to 10 eggs and averaged 7.5 (32 nests) in 1958 and 7.0 (18 nests) in 1959. Hatching was first noted on May 26, 1958, and an adult and five downy young were seen on May 28, 1959.

During the latter half of July young birds appeared in large numbers and by this time the family bond seemed to have largely disappeared in the early broods. On July 19, 1959, a group of 30 mixed adults and young was noted near the dam and on July 25, 56 young were seen in Big Bay. A total of 250 Pied-billed Grebes was counted near the dam and in Big Bay on August 23, 1959.

DOUBLE-CRESTED CORMORANT *Phalacrocorax auritus*. This species is an occasional spring and fall migrant and rare summer visitant. A single bird was identified on June 22, 1956, as it flew over what was presumed to be a new cormorant's nest, three feet up in the branches of a tree that had fallen over into the water. The nest was empty and as far as we know was never occupied.

GREAT BLUE HERON *Ardea herodias*. A common bird in the marsh. Day (1955) recorded finding the nesting colony. This heronry, which was built in the dead trees of a drowned forest at heights of 20 to 30 feet, has had 25 to 30 occupied nests each year from 1955 to 1958. In 1957, nests with large young were noted as late as August 2. Because some of the trees were blown down, the number of occupied nests was reduced to 12 in 1959.

GREEN HERON *Butorides virescens*. A fairly common summer resident. Although no definite nesting record has been established it undoubtedly breeds in Luther Marsh.

COMMON EGRET *Casmerodius albus*. The only record for this species was a single individual observed in a field pond beside the 21st Sideroad of East Luther Township on April 20, 1957.

BLACK-CROWNED NIGHT HERON *Nycticorax nycticorax*. A fairly common bird in the marsh. In June 1955, Day (1955) found a nesting colony of about 20 nests in dead trees in the same heronry as the Great Blue Herons. Nests were used regularly each season until 1959, when the birds abandoned this site. The summer presence of the usual numbers of this species along with immature birds indicated that they were probably occupying new territory elsewhere in the marsh.

LEAST BITTERN *Ixobrychus exilis*. A common inhabitant of the cattail marsh, but owing to its secretive habits not easily observed. Adults were counted in three separate locations on July 25, 1959.

Of four nests found, three were in cattail marsh and one in a small willow in open water. Nests, mostly built of cattails, were eight inches to four feet above the surface of the water, usually one and a half feet above. The average clutch size of four nests was five eggs with extremes of four to six. A nest containing two eggs and four newly hatched young was found on the west side of the marsh on June 9, 1958; another nest had four small young on July 25, 1959. A young bird about three-quarters grown was found at the head of Big Bay on August 3, 1959.

AMERICAN BITTERN *Botaurus lentiginosus.* A very common summer resident. Twenty-five were counted on August 2, 1957.

Of six nests located in 1958 and 1959, three were in the cattail marsh, built over water and the others were in fields, in dry locations some distance from water. Clutch size was five eggs. One nest found in the cattails on a small island contained five eggs of the Bittern and a Ruddy Duck's egg, presumably laid by a bird that nested nearby. The presence of the Ruddy Duck's egg made little difference as an incubating Bittern was flushed from the nest on three visits between June 4 and June 18. Unfortunately, the final outcome was not observed.

WHISTLING SWAN *Olor columbianus.* Occasional spring and fall migrant. A flock of ten was seen to alight near the dam on April 20, 1957, and a single bird was photographed near Windmill Island on September 27, 1958.

CANADA GOOSE *Branta canadensis.* A regular spring and fall migrant. Occasional migrant flocks make use of the marsh as a resting place. On April 20, 1957, a flock of 125 was seen near the dam, while on October 5, 25 were observed. Twelve geese were noted flying over the marsh on September 27, 1958. Five were shot by hunters during the opening day's shoot, October 3, 1959.

MALLARD *Anas platyrhynchos.* Common summer resident, very common fall migrant. This, the second commonest breeding duck, numbered 60 pairs in 1958 and in 1959.

Both the Mallard and its close relative the Black Duck are very versatile in the choice of nesting sites. As most of the observations were made in the marsh and immediate surroundings, no upland nests were located and, owing to the floating nature of the leatherleaf bog, this type of habitat also received rather poor coverage. Therefore, the actual nests found show only part of the true nesting picture.

Eight nests were found in 1958 and 1959. Six of these were on islands; one in a clump of leatherleaf in a bog and one in a field on the mainland near the dam. The last named was the only one located in an area frequented by humans. One island of about three-quarters of an acre contained two nests located about eight feet apart. Both these nests were in the open and were built at the foot of poplars. The other island nests were well concealed in fields usually in a clump of goldenrod at distances varying from 20 to 125 yards from open water. Nests were found from June 4 to June 18 and clutch sizes ranged from six to ten eggs, with an average of 8.4 eggs.

The early hatch apparently occurred during the latter third of May as broods of half-grown young were observed on June 20. A very late date for a brood of downy young was July 28, 1959.

During the fall migration period, an estimated 7,000 Mallards were in the marsh on October 3, 1957.

BLACK DUCK *Anas rubripes.* Common summer resident and very common migrant. This species ranks third as a breeding duck with an estimated 40 pairs in each of the years 1958 and 1959.

Two nests were found in mid-June, 1958. Both were located on islands, one in a clump of goldenrod and the other in grass at the edge of the cattails, and both contained eight eggs.

On October 3, 1957, during a prehunting season census, an estimated 5,000 Black Ducks were in the marsh.

GADWALL *Anas strepera.* A very rare but probably regular summer resident. Two or three pairs nested in 1958 and 1959.

Day (1955) found this species nesting in June, 1955. On June 18, 1958, a nest containing 10 eggs was located by us in a field under a small dogwood (*Cornus stolonifera*) on Middle Island. On August 2, 1959, a female with a brood of three-quarter grown young was noted at Big Bay.

PINTAIL *Anas acuta.* This species nests regularly in small numbers and it seems to be increasing. An estimated 15 pairs were present in 1959. A flock of 62 birds was seen on the east side of the marsh on April 20, 1957.

During the period June 12 to 22, 1955, Day (1955) found one nest and one brood. No nests have been located subsequently but eight broods were observed by us between May 28 and July 28, 1959.

GREEN-WINGED TEAL *Anas carolinensis.* A rare summer resident but fairly common fall migrant. An estimated ten pairs nested in both 1958 and 1959. On May 26, 1958, a nest with nine eggs was found on Middle Island. This nest was subsequently destroyed by a predator.

An estimated 1,000 Green-winged Teal were in the marsh on October 3, 1957.

BLUE-WINGED TEAL *Anas discors.* A very common summer resident and migrant. This was the most abundant breeding duck with an estimated population of 200 pairs in both 1958 and 1959.

This species showed a decided preference for islands as nesting sites although nests were found also in fields adjacent to the marsh. In 1958 and 1959, 31 nests were located and of these 25 were on islands and six were on the mainland. On Middle Island, which has an area of approximately 10 acres, five nests were found in 1958. Typical nests were built in slight depressions in the ground, usually well concealed in long grass and at distances varying from 30 to 200 yards from water.

Nesting was under way by the second week of May and reached its height during the last week of that month and the first week of June. Our latest nest, with the female incubating eight eggs, was found on July 19, 1959. The average clutch size for 30 nests was 10.9, with extremes being 6 to 14 eggs. Broods of young were often encountered in early summer and, during August, the marsh served as a concentration area for locally reared ducks and migrants. During this period it was possible to find large flocks such as 186 on August 8, 1959, on the east side, 500 near the dam and 100 in Big Bay on August 23, 1959.

This species made up 17.2 percent of the ducks shot on the opening day of the hunting season on October 3, 1959.

AMERICAN WIDGEON *Mareca americana.* Baldpates bred in small numbers and were occasionally fairly common during the fall migration. In 1959, an estimated 15 pairs nested in the marsh. On July 4, 1959, a female with a brood of nine downies was seen on the east side of the marsh.

Our highest fall count was 200 on Big Bay on September 26, 1959.

SHOVELER *Spatula clypeata.* Although there are no definite nesting records, it is probable that a few Shovelers breed in Luther Marsh. One pair was seen on May 17, 1958, and another, possibly the same pair, on June 18, 1958. Two pairs were noted on May 28, 1959, and two males engaged in a neck-stretching and dipping display were observed near the dam on June 13, 1959.

WOOD DUCK *Aix sponsa.* There is no evidence of breeding. A few suitable nesting cavities exist in the drowned swamp forest, but examinations of these have yielded no results and no broods have been seen.

Most records of this species are for late summer and fall. Fifty were seen on August 22, 1952, and an estimated 100 on October 3, 1957, during a prehunting season census.

REDHEAD *Aythya americana.* Rare summer resident and spring and fall migrant.

This species increased locally in 1959, when seven pairs were located during the spring and summer. On August 8, a brood of eight downies and another of half-grown young were seen. In addition to these, seven adults were observed on the same day. A flightless male was seen on July 25, 1959, in the open marsh.

An estimated 200 Redheads were noted on the marsh on October 3, 1957, during a prehunting season census.

RING-NECKED DUCK *Aythya collaris.* A fairly common summer resident and fall migrant. An estimated 25 pairs bred annually during 1958 and 1959.

A nest with six eggs was located on June 10, 1959, in a clump of sedge on a boggy island. This nest also contained one egg of the Ruddy Duck.

On June 18, 1958, a brood of 11 downies was seen on the north side of the marsh and on June 10, 1959, a brood of eight downy young was observed.

The largest count for one day was an estimated 200 on October 3, 1957.

CANVASBACK *Aythya valisineria.* This species has been recorded irregularly as a rare spring and fall migrant. There was no evidence of breeding.

Spring observations were 28 on April 20, 1957 and three on April 28, 1957. Fifteen were counted on November 9, 1954 and six on November 16, 1954.

GREATER SCAUP *Aythya marila.* The only definite records for this species are from the game-bag censuses when two were checked on October 2, 1954, and 12 on October 6, 1956.

LESSER SCAUP *Aythya affinis.* Rare summer resident, breeding in small numbers; uncommon spring and fall migrant.

On June 7, 1960, a nest of 12 eggs was found by Boyer on a small island in the middle of the marsh.

COMMON GOLDENEYE *Bucephala clangula.* Rare spring and fall migrant. Seven were seen near the dam on April 20, 1957. Two were recorded on October 5, 1957, and fifteen on November 19, 1954.

BUFFLEHEAD *Bucephala albeola.* Rare spring and fall migrant. Fifty-seven were seen on April 28, 1957. Four were noted on September 27, 1958 and one on November 16, 1954.

RUDDY DUCK *Oxyura jamaicensis.* Uncommon summer resident and spring and fall migrant. An estimated 12 pairs bred in 1959.

The first direct evidence of nesting occurred in 1958, when a nest with three eggs was found in cattails on an island on June 4. The completed clutch for this nest was eight eggs. On June 20, 1959, a nest with three eggs was located in a cattail marsh on Windmill Island and on the same day a nest with ten eggs was found on a boggy island on the west side about three yards from open water. The latter had no nesting material except a very small amount of dried sedge. Two nests noted on the east side and at the end of Big Bay on July 4, 1959, had 16 and 5 eggs, respectively. Both these nests were in cattails and were constructed of cattails lined with shredded leaves of the same material. Very little down was found in either nest. On August 2, 1959, a nest, which had been broken up by an unidentified mammal, was found in the cattails at Big Bay and, on the following day, a nest with four eggs was discovered about 100 yards away. The latter was built on an old Coot's nest.

Two half-grown broods, containing five and six young, respectively, and one brood of nine large young were seen on the west side on July 25, 1959. A female with five half-grown young was seen at Big Bay on August 8, 1959. Also scattered around this general area were five young which did not seem to belong to any special brood.

During the opening day of the hunting season on October 3, 1959, 34 Ruddy Ducks were recorded in the hunters' bags.

HOODED MERGANSER *Lophodytes cucullatus.* Uncommon spring and fall migrant and rare summer resident. No evidence of breeding has yet been obtained although three birds were observed in the western part of the marsh on June 18, 1958. A pair was seen on May 16, 1959.

During the prehunting census on October 3, 1957, an estimated 100 were present in the marsh. Fifteen were examined during the hunters' bag check on October 3, 1959.

COMMON MERGANSER *Mergus merganser.* A rare spring and fall migrant. Eight were found near the dam on April 20, 1957, and four turned up in the hunters' bags on October 2, 1954.

RED-BREASTED MERGANSER *Mergus serrator.* A rare spring migrant. A male and female were observed on May 28, 1959, and two others were recorded near the dam on April 20, 1957.

MARSH HAWK *Circus cyaneus.* A fairly common resident of the marsh, one to four birds being observed on each visit. Although we have not seen a nest, one of the workmen for the Grand Valley Conservation Authority informed us that he had found a hawk's nest on the ground along the east side of the marsh in 1959.

OSPREY *Pandion haliaetus.* Our only record is of a single bird perched in a tree on the east shore on July 18, 1956.

VIRGINIA RAIL *Rallus limicola.* An uncommon summer resident. Merriam and Gillespie (1956) recorded one on July 2, 1956. In 1958, two nests were found by us, one with eight eggs on May 30, and the other with ten eggs on June 6.

SORA *Porzana carolina.* Not uncommon in suitable habitat. Day (1955) recorded several in the south area and believed they nested. We noted three on Middle Island on August 2, 1957. A nest with nine eggs was found on June 6, 1958, in a tuft of grass in a *Typha* marsh, 30 yards from open water; it had ten eggs on June 7.

COMMON GALLINULE *Gallinula chloropus.* A rather uncommon summer resident of the marsh. Day (1955) recorded it on the east side. In 1958, we found a nest with nine eggs on May 30 and another with three eggs on June 9. The latter nest was composed of

Typha and built in a clump of *Chamaedaphne* where the water was two and a half feet deep. Three nests were found in 1959: on June 20, a nest of five eggs and one newly hatched young was discovered on a boggy island on the west side of the marsh; while on June 30, nests with six and five eggs were seen in the south side of the marsh.

AMERICAN COOT *Fulica americana*. Abundant summer resident and fall migrant.

Nesting was almost exclusively confined to the cattail marsh. A total of 82 nests was located in 1958 and 1959. Nests averaged 100 yards apart. Typical nests were constructed of *Typha* and built over water, usually where the depth was one to two feet.

In 1958, the average clutch for 30 nests was 10.0 eggs while, in 1959, 14 nests averaged 9.3 eggs. Extremes for both years were 8 and 12 eggs. Nesting was well under way by the first week in May and young appeared by the end of the month. The latest date for a nest with eggs was July 25, 1959.

In late summer there were large numbers of young in favored feeding areas. On July 25, 1959, 142 flightless young were counted in Big Bay alone.

The highest single estimate of fall concentrations was 1,000 on October 3, 1957. Coots form an important part of the annual waterfowl harvest as evidenced by 294 taken by hunters on October 3, 1959.

SEMIPALMATED PLOVER *Charadrius semipalmatus*. Uncommon spring and fall migrant. Two were seen on the east side of the marsh on May 26, 1958. Evidence of a southward movement was noted when one was seen on July 25, and two on July 28, 1959. The largest number recorded in one day was 25 on October 5, 1957.

KILLDEER *Charadrius vociferus*. Often seen around the shores of the marsh. Three young were found near the dam on July 19, 1959. The marsh afforded a concentration point in the fall when flocks of up to 50 were sometimes observed.

AMERICAN GOLDEN PLOVER *Pluvialis dominica*. Very rare migrant. One was noted in the eastern part of the marsh on September 28, 1957. A Golden Plover was shot by a hunter on October 5, 1957.

BLACK-BELLIED PLOVER *Squatarola squatarola*. Uncommon spring and fall migrant. On May 26, 1958, a group of 50 was seen on the west side of the marsh. Southbound migrants have been recorded as follows: on September 26, 1959, two; on September 29, 1953, eleven; and on October 3, 1957, twenty.

COMMON SNIPE *Capella gallinago*. This species occurred regularly during the breeding season and, although no direct evidence was secured, it undoubtedly nests at the marsh.

It was recorded as early as May 14 in 1958; and, in 1959, nine were seen on July 28 and seven on August 2. Our latest fall observation was October 5, 1957.

SPOTTED SANDPIPER *Actitis macularia*. Occasionally observed about the shores of the marsh; a few pairs remained to nest. On June 7, 1958, a nest of four eggs was found in a field on the east side of the marsh about 125 yards from the water. A small downy young was seen running on the shore near the dam on July 19, 1959.

SOLITARY SANDPIPER *Tringa solitaria*. A rare late-summer migrant. One was seen at Big Bay on July 18, 1958, and another on July 28, 1959.

GREATER YELLOWLEGS *Totanus melanoleucus*. A rare spring and fairly common fall migrant.

The usual high-water levels of spring probably discourage many shore birds from stopping during their northward migration. Drawdowns in midsummer expose a narrow muddy shore, which proves attractive to waders. Spring dates for this species ranged from April 28 (1957) to June 6 (1958).

Southbound migrants usually appeared during the third week of July and were noted regularly during August and September. The latest fall observation was November 8, 1958.

LESSER YELLOWLEGS *Totanus flavipes*. A rare spring and fairly common fall migrant. Three were seen at Big Bay on May 18, 1958. The first southbound transients were seen on July 18 in 1956, and on July 19 in 1959. It was recorded regularly throughout the fall, our latest observation was October 3, 1957, when 15 were seen.

PECTORAL SANDPIPER *Erolia melanotos*. A very rare fall migrant. Two birds were seen on September 27, 1958, our only record.

LEAST SANDPIPER *Erolia minutilla*. An uncommon fall migrant. Dates for the southward migration ranged from July 18 (1956) to October 5 (1957).

DUNLIN *Erolia alpina*. A rare spring and uncommon fall migrant. On May 30, 1958, nine were seen on the east shore of the

marsh. This species again appeared during September and October. The largest number seen in a day was 25 (October 5, 1957).

SHORT-BILLED DOWITCHER *Limnodromus griseus.* A rare fall migrant. In 1959, five were observed on July 19, and one on September 26. The latest fall occurrence was one of September 28, 1957.

STILT SANDPIPER *Micropalama himantopus.* A very rare migrant. Our only record was a single bird near the dam on July 19, 1959.

SEMIPALMATED SANDPIPER *Ereunetes pusillus.* It has been seen but once, a single bird on June 6, 1959. Undoubtedly it occurs much more commonly than our records indicate.

WILSON'S PHALAROPE *Steganopus tricolor.* One of the pleasant surprises of our work at Luther Marsh was finding this species as a summer resident. Its status as a breeding bird was established on June 10, 1958, when a nest of four eggs was found on one of the islands. It was estimated that six pairs were present at the marsh in 1958. Birds showing definite territorial behavior were again seen in June, 1959.

NORTHERN PHALAROPE *Lobipes lobatus.* A very rare migrant. It was recorded only once, when two birds were observed on Middle Island, September 29, 1953.

HERRING GULL *Larus argentatus.* A few Herring Gulls could be seen flying over the marsh during most visits.

RING-BILLED GULL *Larus delawarensis.* This gull is a late summer visitant, rarely appearing before the middle of July. From then on, a few birds are to be seen regularly into October.

BLACK TERN *Chlidonias niger.* An abundant breeding bird. Nests were usually built on floating material such as logs, sticks and mats of dead cattail stems. Nesting was under way by the last week of May and reached its height in early June. A late nest of three eggs was found on June 30, 1959. On July 19, 1959, several young capable of flight were noted around the dam.

This species leaves the marsh early and is seldom recorded after mid-August.

EASTERN KINGBIRD *Tyrannus tyrannus.* Common especially in swampy areas where dead trees remained standing. A nest with three eggs was located four and a half feet up in a dead bush over water on June 7, 1958, and another nest containing one egg was found in an apple tree near the dam on June 13, 1959.

TREE SWALLOW *Iridoprocne bicolor.* Common over the marsh. Dead trees left standing when the water level was raised are utilized as nesting sites.

BARN SWALLOW *Hirundo rustica.* Occasionally noted flying over the marsh. A few pairs were found nesting in an old barn on the east side in June, 1958.

COMMON CROW *Corvus brachyrhynchos.* Crows were often seen about the marsh, usually in small groups of four to ten individuals. We found little evidence that they molested other nesting birds in the marsh.

LONG-BILLED MARSH WREN *Telmatodytes palustris.* With the development of the *Typha* growth around the marsh this wren has become quite common. Now few suitable stands of cattail are without their rattling songs.

Many nests have been observed. Nests with eggs have been noted as early as June 9. The average clutch size was five eggs, with a set of six eggs being found in 1958. A late nest still had four small young on July 25, 1959.

BOBOLINK *Dolichonyx oryzivorus.* This was a common inhabitant of the fields bordering the marsh. A nest containing five eggs was located on June 7, 1958, just north of the 7th Concession Sideroad of East Luther Township, and several young on the wing were noted in a field on the east side on July 19, 1959.

Sizable concentrations are occasionally seen in late summer. A flock of about 100 birds was noted feeding in a weedy field at the junction of the 7th Concession and 21st Sideroad of East Luther Township on August 23, 1959.

EASTERN MEADOWLARK *Sturnella magna.* A fairly common inhabitant of the meadows surrounding the marsh. Nests were not found but the behavior of the birds indicated nests or young close at hand.

REDWINGED BLACKBIRD *Agelaius phoeniceus.* An abundant nesting species. Many nests were examined by us. Typical nests were built two or three feet up in stands of *Typha* over water, three to five yards from the shore. However, this species also nested near water in dead apple trees, dead hawthorns and willows.

The average clutch size for 25 nests was 3.8 eggs, five eggs being the largest set recorded. In early nests, egg laying began about May 1, and late nests still had eggs on July 4. Our latest nest had large young on July 25, 1959.

COMMON GRACKLE *Quiscalus quiscula.* Occasionally found around the marsh borders, especially where dead trees remained standing.

Nests were found in 1956, 1958 and 1959. These were usually built in dead trees or stubs over water. A nest with five eggs found on May 26, 1958, had two young and three eggs on May 30. It contained five well-grown young on June 6.

SAVANNAH SPARROW *Passerculus sandwichensis.* This is an abundant breeding bird in the grassland bordering the marsh. They were often seen feeding along the shore margins. In 1959, a nest containing five eggs was seen in a field near the dam on June 13 and another nest with four small young was located on July 25, at Big Bay.

SWAMP SPARROW *Melospiza georgiana.* A rather uncommon summer resident. Noted on only two occasions in the marsh. Nests were not found but it probably breeds sparingly in suitable habitat.

SONG SPARROW *Melospiza melodia.* Common summer resident. Frequently noted in abandoned farmland bordering the marsh, especially where there was brushy cover. Young birds out of the nest being fed by adults were noted on June 2, 1957, along the 7th Concession Sideroad of East Luther Township.

FALL USE BY WATERFOWL

Luther Marsh provides an ideal resting place for migrating waterfowl. About mid-August a noticeable increase in the local duck population is evident. This is believed due to a movement of birds from potholes and small marshes adjacent to Luther Marsh. This concentration tends to build up slowly until by the opening of the duck-hunting season in early October, it is quite large. Shooting no doubt disperses many of these birds but some remain until freeze-up.

During a preseason waterfowl census by boat on October 3, 1957, we estimated that there were 15,000 ducks in the marsh.

A further indication of numbers can be had from the game bag census figures obtained by the Ontario Department of Lands and Forests on the opening day of the duck hunting season for the years 1953 to 1959 inclusive. Data for these years are given in Tables 1 and 2.

TABLE 1. GAME BAG CENSUS CHECKS MADE ON OPENING DAY OF WATERFOWL HUNTING SEASON AT LUTHER MARSH, ONTARIO, FOR THE YEARS 1953-1959

Year	Number of Hunters Checked	Number of Ducks Checked*	Hunter Success (Ducks per Hunter)
1953	207	258	1.24
1954	729	494	.67
1955	639	501	.78
1956	589	613	1.04
1957	426	246	.58
1958	918	1,533	1.67
1959	1,564	1,723	1.10

*Checked by the Department of Lands and Forests officers on opening day only. The actual season's kill would be considerably higher.

TABLE 2. THE PERCENTAGE OF EACH SPECIES OF WATERFOWL EXAMINED DURING GAME BAG CHECKS ON OPENING DAY OF HUNTING SEASON AT LUTHER MARSH, ONTARIO FOR THE YEARS 1953-1959

Species	1953	1954	1955	1956	1957	1958	1959
Black Duck	41.0	9.9	27.1	26.5	22.0	25.1	20.8
Mallard	16.6	10.7	17.5	25.2	23.0	32.1	23.1
Green-winged Teal	10.9	29.9	20.7	16.3	3.0	17.3	5.7
Blue-winged Teal	14.6	25.3	18.1	10.4	10.0	8.4	17.2
Pintail	4.0	0.4	1.5	3.5		3.1	1.7
Ruddy Duck		1.6	2.5	2.1	4.0	0.3	1.7
Scaup sp.		0.4	2.0	1.9	1.0	1.8	0.7
American Widgeon		0.2	3.3	1.6	1.0	0.9	1.4
Ring-necked Duck		1.8	1.9	1.4	3.0	0.8	1.6
Redhead			1.9	0.9	3.0	1.3	0.8
Wood Duck		3.4	0.5	0.8		0.3	1.0
Common Goldeneye		0.4					
Gadwall				0.8		2.0	0.4
Bufflehead							0.1
Canvasback				0.1		0.1	
Merganser sp.		0.8	2.2	0.4	1.0	0.9	0.7
Shoveler		0.4				0.1	0.1
American Coot		12.9		5.7	22.0	4.3	14.5
Canada Goose							0.2
Common Snipe						0.1	
Unidentified	12.9	1.9	0.8	2.4	7.0		7.5

DISCUSSION AND RECOMMENDATIONS

At the present time, it would seem that any program of waterfowl management at Luther Marsh would have to be subordinate to that of flood control, which was the primary purpose of the project. Luther Marsh has demonstrated to some extent the potentialities of large artificial impoundments in southern Ontario. There has been a substantial increase in species of water birds already common to the region and an extension of ranges of others such as the Gadwall, Redhead, and Ruddy Duck.

With the adverse conditions now affecting ducks on the prairies, eastern marshes such as Luther take on increased importance as duck-producing areas.

In conclusion the authors recommend that:

A. In order to provide a basis for future wet-land programs in southern Ontario, further studies of the vegetation and physical characteristics of the marsh be undertaken.

B. Because existing herbaceous vegetation provides food and nesting cover for breeding waterfowl, no trees be planted on the islands.

C. Adequate fences be built to keep livestock out of the marsh.

D. A program of banding locally raised ducks be carried out in order to increase our knowledge of the migratory movements of these birds.

SUMMARY

In 1952, in Ontario, over 4,500 acres of land known as the Luther Swamp was flooded by the erection of a dam across the Black Creek, a tributary of the Grand River. Flood control and water conservation were the main purposes of the project, but an added benefit was the creation of new habitat for waterfowl and other wildlife.

Cursory observations from 1952 to 1957 and more extensive studies during 1958 and 1959 enabled the authors to prepare an annotated list of the breeding birds and an estimate of waterfowl breeding stock.

A description of habitats, and the birds associated with each type, has been given.

The importance of the marsh both as a duck production center and as a resting place for migratory waterfowl has been demonstrated.

Some suggestions have been offered for the future management of the marsh.

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Annual Meeting of the Ottawa Field-Naturalists' Club

The annual meeting will be held on Tuesday, December 5, 1961, at 8.15 p.m., in the conference room of the K. W. Neatby Building, Carling Avenue.

SPIDERS AND HARVESTMEN TRAPPED ON THE SURFACE OF SPETTIGUE'S POND AT LONDON, ONTARIO

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During the summer months of 1960 insects emerging as adults at the surface of Spettigue's Pond at London, Ontario, were collected in five tent traps floating on the surface. At the same time spiders and harvestmen found in and on the traps were collected and their numbers and seasonal distribution were noted.

Description of the Pond

Spettigue's Pond is one of a group of three kettle lakes situated in London near the northeast corner of Wellington Road and the road separating what were Concessions 1 and 2 of the Township of Westminster before this area was annexed to the City of London in 1961. An investigation of the insects emerging from the most southerly of the ponds, South Walker Pond, was conducted by Judd (1960) in 1956. (The co-ordinate point shown on the map of South Walker Pond by Judd (1960) was erroneously designated at 52° 57′ 45″ N 80° 13′ W and should be 52° 56′ 45″ N 81° 13′ W). Spettigue's Pond is the most easterly of the three ponds and is situated just east of the co-ordinate point 42° N 81° 13′ W (Figure 1, B). The pond is named after the former owner of the farm on which it is located. It is now the property of the Department of Veterans Affairs.

Spettigue's Pond is about 1000 feet long in the east-west direction and lies in a shallow depression ringed by low hills. It is entirely surrounded by woods and access to it is by footpaths through the woods. In spring, rain and melting ice cause flooding around the pond outward to about the line indicating 900 feet above sea level (Figure 1). Beyond this the terrain slopes rapidly upward. During 1960 floating vegetation extended outward from the shore to the line indicated by A-A-A in Figure 1. This vegetation included waterlily *Nymphaea odorata* Ait.) and pondweeds (*Potamogeton gramineus* L. and *P. amplifolius* Tuckerm.); and some spatterdock (*Nuphar advena* (Ait.) Ait. f.) was present at the west end of the pond. Green submerged masses of stonewort (*Chara* sp.) occurred beneath the floating vegetation.

Surrounding the whole pond is a floating mat of bog formation from 5 to 20 feet wide based on a dense mat of *Sphagnum*. The predominant plant here is leatherleaf (*Chamaedaphne calyculata* (L.) Moench.). Growing among the bushes of leatherleaf are black highbush blueberry (*Vaccinium atrococcum* (Gray) Heller), buck bean (*Menyanthes trifoliata* L.), pitcher plant (*Sarracenia purpurea* L.), marsh cinquefoil (*Potentilla palustris* (L.) Scop.) and large cranberry (*Vaccinium macrocarpon* Ait.). The predominant tree here is larch (*Larix laricina* (DuRoi) K. Koch). There are sparse stands of cattail (*Typha latifolia* L.), and in the southeast corner of the pond the outer edge of the bog formation is fringed by water-willow (*Decodon verticillatus* (L). Ell.). From the edge of the bog formation to about the 900-foot contour swampy conditions

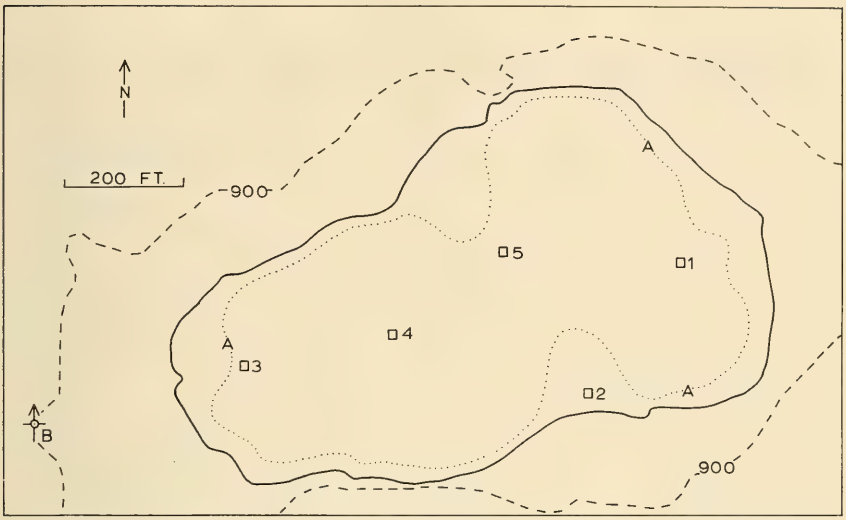

FIGURE 1. Map of Spettigue's Pond showing location of the five tent traps (squares, 1-5). A-A-A, outer limits of floating vegetation; B, location of co-ordinate point 42° 57′ N 81° 13′ W; 900-900, contour line 900 feet above sea level.

prevail. Trees here include yellow birch (*Betula lutea* Michx. f.), blue-beech (*Carpinus caroliniana* Walt.), red maple (*Acer rubrum* L.), silver maple (*Acer saccharinum* L.) and white elm (*Ulmus americana* L.). Shrubs present are winterberry (*Ilex verticillata* (L.) Gray), purple chokeberry (*Pyrus floribunda* Lindl.), poison sumac (*Rhus vernix* L.), alder buckthorn (*Rhamnus frangula* L.) and common elder (*Sambucus canadensis* L.). Beneath the trees are skunk-cabbage (*Symplocarpus foetidus* (L.) Nutt.), sensitive fern (*Onoclea sensibilis* L.), royal fern (*Osmunda regalis* L.), wild lily-of-the-valley (*Maianthemum canadense* Desf.), goldthread (*Coptis groenlandica* (Oeder) Fern.), wild sarsparilla (*Aralia nudicaulis* L.), purple trillium (*Trillium erectum* L.), star flower (*Trientalis borealis* Raf.), jack-in-the-pulpit (*Arisaema atrorubens* (Ait.) Blume), false spikenard (*Smilacina racemosa* (L.) Desf.) and Indian cucumberroot (*Medeola virginiana* L.).

Outside the swampy area the slopes are wooded with beech (*Fagus grandifolia* Ehrh.), sugar maple (*Acer saccharum* Marsh.), black cherry (*Prunus serotina* Ehrh.), white elm (*Ulmus americana* L.), red oak (*Quercus rubra* L.), hawthorn (*Crataegus* spp.), chokecherry (*Prunus virginiana* L.), bitternut hickory (*Carya cordiformis* (Wang.) K. Koch) and shrubs of witch-hazel (*Hamamelis virginiana* L.). Plants blooming here in spring include spring beauty (*Claytonia virginica* L.), white trillium (*Trillium grandiflorum* (Michx.) Salisb.), yellow adder's-tongue (*Erythronium americanum* Ker), may-apple (*Podophyllum peltatum* L.), spotted crane's-bill (*Geranium maculatum* L.) and early meadow-rue (*Thalictrum dioicum* L.).

METHODS

Insects were trapped in a floating tent trap set out on the water at each of five collection sites (Figure 1). Each trap was of the type described by Judd (1957), built to enclose four square feet of water surface. The five traps were set in position on April 22 and were removed from the water on October 5. Trap 1 was placed on water 17 feet deep and 150 feet from the east shore, Trap 2 on water 3 feet deep and 25 feet from the south shore, Trap 3 on water 4 feet deep and 100 feet from the west shore, Trap 4 on water 22 feet deep and 200 feet from the north shore and Trap 5 on water 7 feet deep and 200 feet from the north shore. There was no vegetation at Traps 1 and 4. Trap 2 had in and around it leaves of *Nymphaea odorata* and *Potamogeton gramineus* and beneath it masses of *Chara* sp. Trap 3 was anchored just off a growth of *Nymphaea odorata*, *Nuphar advena* and *P. gramineus* and had beneath it masses of *Chara* sp. Trap 5 was anchored about 25 feet from a growth of *Nymphaea odorata* and *P. gramineus* and had beneath it masses of *Chara* sp.

Each day the insects caught in each trap were collected, as described by Judd (1960). At the same time, harvestmen and spiders found in and on the traps were collected. They were identified by Dr. C. D. Dondale, Research Station, Canada Department of Agriculture, Kentville, Nova Scotia. All specimens are deposited in the collection of the Department of Zoology, University of Western Ontario, except those noted as being retained (ret.) by Dr. Dondale for the Canadian National Collection. This project was supported by funds granted by the Ontario Research Foundation. During the summer of 1960 Mr. M. S. Beverley, Research Assistant, made collections at the traps, sorted out the specimens and recorded their numbers.

ACCOUNT OF COLLECTIONS

PHALANGIIDAE

Leiobunum ventricosum (Wood) — Trap 4: 1 harvestman, June 18.
Opilio parietinus (DeGeer) — Trap 5: 1 harvestman, June 15.

DICTYNIDAE

Dictyna manitoba Ivie — Trap 2: 2♀♀, May 31, June 4 (ret.).

THERIDIIDAE

Theridion frondeum (Hentz) — Trap 2: 1 spider, May 30.

LINYPHIIDAE

Erigone atra Balckw. — Trap 1: 1♂, September 1; Trap 2: 1♂, July 8 (ret.), 1♀, August 2 (ret.); Trap 5: 2♀♀, July 12, August 13.
Erigone sp. — Trap 2: 1♀, May 28; Trap 3: 1♀, August 12.
Maso sp. — Trap 4: 1♀, June 1.
Erigonid — Trap 2: 1 immature ♂, June 18.
Linyphiid — Trap 1: 1♀, June 1.

ARGIOPIDAE

Araneus sp. — Trap 3: 1 immature, June 8.
Pachygnatha sp. — Trap 1: 1 immature, July 20; Trap 2: 1 immature, August 21; Trap 3: 1 immature, June 19.
Tetragnatha elongata Walck. — Trap 2: 3 immature, July 21, August 14, 27; Trap 3: 1 immature, September 13; Trap 4: 1 immature, June 28; Trap 5: 3 immature, September 2.
Tetragnatha straminea Em. — Trap 5: 1♂, May 19.
Tetragnatha versicolor Walck. — Trap 2: 3 immature, August 21, September 3, 8; Trap 5: 2 immature, May 25, August 2.

PSIAURIDAE

Dapanus sp.—Trap 1: 1 immature, July 23; Trap 2: 3 immature, July 16, 26, September 3; Trap 3: 1 immature, July 25; Trap 5: 3 immature, July 19, August 18, September 2.

LYCOSIDAE

Lycosa helluo Walck.— Trap 3: 1♂, July 24 (ret.).
Pirata sp.— Trap 1: 1 immature, July 13; Trap 2: 3 immature, June 11, July 30, September 7; Trap 3: immature, July 19.

ATTIDAE

Sitticus palustris (Peckh.) —Trap 3: 1♀, June 21 (ret.).

Altogether, 46 spiders and 2 harvestmen were collected from the traps. In order of decreasing numbers at the traps, there were: 20 at Trap 2, 12 at Trap 5, 8 at Trap 3, 5 at Trap 1 and 3 at Trap 4. This distribution coincides closely with the relative closeness of the traps to the shore and the proximity of vegetation to the traps; the greatest numbers collected were at Trap 2, which was closest to shore and surrounded by vegetation, and the least numbers were at Trap 4, which was farthest from shore and had no vegetation near it.

Most of the species of harvestmen and spiders collected, those in the genera *Leiobunum*, *Opilio*, *Dictyna*, *Theridion*, *Erigone*, *Maso*, *Araneus*, *Dapanus* and *Sitticus*, are described by Comstock (1948) as being terrestrial in habit; thus they probably reached the traps by being swept over the pond by wind and water or made their way from shore over vegetation. Twenty-three of the spiders collected, half the total catch, are in genera (*Pachygnatha*, *Tetragnatha*, *Lycosa* and *Pirata*) which include species associated with water (Comstock, 1948). Wolf spiders of the genera *Lycosa* and *Pirata* run on the water and dive freely beneath it, and orb weavers of the genera *Pachygnatha* and *Tetragnatha* occur on plants over water. The spiders in these four genera were thus in their usual habitat at Spettigue's Pond. The commonest species occurring in the collections, *Tetragnatha elongata*, prefers damp situations and often makes its web over water (Comstock, 1948).

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YEARLY OCCURRENCE OF COMMON GRACKLES IN DRY LOBSTER POTS

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At the Marine Biological Laboratory, Grindstone, Magdalen Islands, Quebec, many lobster pots not being used are stacked in closed rows about eight feet high in a sheltered portion of the yard between the main buildings and a thick grove of spruce trees. A colony of Common Grackles, *Quiscalus quiscula*, which nest yearly in this grove, often find their way into the lobster cages and are trapped.

When observations were made in 1957 and 1958 a pattern became evident, but it was not until 1960 that a more complete record was obtained. The birds began to enter the traps about the first week in July, after the young were well feathered and capable of feeding on their own; they continued to go into the traps for three or four weeks, then, as the breeding cycle ended, they left the nesting area. An exception was noticed in 1957, at the end of September, well past the general migration of grackles from this area, when 17 grackles were located, sometimes four or five in a cage.

There is no direct evidence to indicate why the birds entered the lobster traps. At first it was thought they were searching for small pieces of bait that had dried on the laths and netting, but in 1958 it was discovered that grackles also entered cages that had not been fished and contained no waste or dry matter. It was then assumed that only immature birds entered, possibly seeking a shelter from storms, and that the adult birds were trapped as they attempted to encourage their young to leave. Some adults may have had such intention but other adults, taken in 1960, were at various heights on the racks and often at opposite ends, far removed from juveniles, and at a time when the weather was calm.

In 1959, however, the lobster pots were stored, though not purposely, in a different area away from the buildings, facing the sea. No grackles entered these traps even though the traps had been used and contained portions of dried herring, kelp, sea urchins, rock crab, and irish moss. The traps did attract several Starlings that were nesting on cliffs near by, and they were often seen leaving the traps with traces of material in their beaks, but none were trapped. This seemed to indicate the presence of some other inducement, such as insects, particularly moths, which gather around the traps at sunrise.

In 1960 some of the lobster pots were stored in the sheltered area and some were left in the open yard. Catches commenced on July 6 from dry cages that had never been used. Again, no grackles were taken from cages located in the exposed area; therefore it was thought that cages stacked where there was no shelter from winds were not likely to attract many insects, and for that reason did not attract grackles.

In every instance in 1960, grackles were found only in the morning, and none were observed near the cages during the remainder of the day. Since no grackles were found in the traps at twilight in the evening it was believed

TABLE 1. GRACKLES IN LOBSTER TRAPS, JULY 1960

Date	Adult Males	Adult Females	Immature	Daily Total
6	1	0	3	4
9	1	1	5	7
11	0	1	4	5
15	3	4	5	12
18	0	1	4	5
21	0	0	2	2
25	1	0	1	2
28	0	0	1	1
Total	6		25	38

they entered at daybreak, when they normally would be searching for food and when nocturnal insects would be settling.

In an attempt to discover whether any released grackles returned to the lobster pots a small experiment was carried out for three weeks. Immature birds were determined by the brown eyes, as opposed to the yellow of the adult. The male and female were determined by plumage. Before being released, the birds were marked lightly with a daub of red paint on the back portion of the neck feathers. It was thought that this method would be satisfactory for the short time needed for the experiment and that the paint would disappear with the regular yearly molt.

Throughout July, which was the extent of this trial, no grackles were found to have returned to the cages, and no captive birds showed signs of having lost painted feathers by preening or other means. In fact, the number of trapped grackles declined, as they had in 1957 and 1958. Table 1 gives an over-all count of the 1960 catches. Only those days when grackles were observed in traps are listed. It can readily be seen that immature birds far outnumbered adults and that a peak was reached at the middle of the month, which may coincide with the time when most of the birds have left their nest. There is an average of approximately two days between catches and it is assumed that the grackles may have been cautious of the cages after each capture. In each case the birds were released as soon as possible in the morning. As far as could be determined, no deaths were caused by their accidental capture. Some were completely exhausted from their attempts to escape, and flight and tail feathers were slightly damaged; however, all were capable of extended flight when released.

Unfortunately, very little time could be given to this experiment and no attempt was made to bait the traps and test their use in this respect. No grackles were opened for the purpose of examining the contents of their crops, but their droppings in the cages indicated a main diet of wild fruit, possibly strawberries, which were extremely abundant in the surrounding fields.

Grackles were the only birds taken. This may have been because their larger size made them unable to escape through the slats and woven netting. Other birds sighted in the area throughout the months of June and July included Robins, Starlings, Fox Sparrows, White-throated Sparrows, and a few wood warblers. The Starlings were very bold and investigated many of the traps that had been fished.

It is possible that grackles enter cages in other lobster areas. In fact, Mr. S. E. Vass of the Fisheries Research Board, Sub-Station, at Ellerslie, Prince Edward Island, told me he had seen one specimen trapped in such a manner. At any rate, lobster pots in this particular section have an irresistible fascination for grackles.

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SOME FACTORS AFFECTING THE HABITAT SELECTION OF THE WHITE-FOOTED MOUSE

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INTRODUCTION

DURING a study of factors affecting the abundance of white-footed mice, *Peromyscus leucopus noveboracensis* (Fischer) (Bendell, 1959), I obtained data on the places where mice were caught. The purpose of this report is to describe the distribution of mice on the study areas and explain, insofar as possible, the factors affecting the habitat selection of mice.

Trapping success was assumed to reflect how frequently mice occurred in an area. When captures of mice were tested against the Poisson distribution, in no case could captures be explained as a result of a random distribution of mice ($P < .05$). Hence, to explain the distribution of mice, I examined some properties of the mice and their habitat.

The distribution of mice was examined in relation to the properties of their population, the supply of food, and the amount and kind of cover offered by the vegetation and forest floor. The cover was a natural condition. A supply of food was added to one area as an experimental manipulation. In response to the supply of food, the properties of one population varied greatly over the study. This population was compared with a natural population on a similar area. By properties of population I mean density, sex ratio, and age-class composition. These data are taken from Bendell (1959) unless noted otherwise.

Most data were gathered from May to August in the years 1954 to 1956. Trapping was done on Sheep and Cow islands in Lake Opinicon. Sheep Island is 3.2 acres in area, Cow Island is 11.3 acres. Lake Opinicon is in eastern Ontario, about one-third the distance to Ottawa on a line from Kingston to Ottawa. The area is well within the published range of the

white-footed mouse (Downing, 1958). The geology of the area is described briefly by Keith (*in* Curran, 1947). According to Rowe (1959), Lake Opinicon is in the Great Lakes–St. Lawrence Forest Region, and Middle Ottawa Section of the forest regions of Canada. The vegetation about the lake is a patchwork of fields and woodlots; the islands are mostly forested. The woodlots are a mixture of deciduous and coniferous trees with deciduous trees dominant on the uplands. The sandy soil of the region is underlain by granites and coarse crystalline limestone, which frequently protrude as low ridges, cliffs, and areas of broken rock.

METHODS

METHOD OF TRAPPING MICE

The details of trapping method are set out in Bendell (1959). Trapping procedure was the same on both islands. Mice were captured in live traps, aged by pelage, sexed, banded or checked, and released. The live traps were set in pairs in a grid of 50-foot intervals on Sheep Island, 100 foot intervals on Cow Island. The grids of traps virtually covered each island. This and the isolation provided by the islands eliminated the effect of immigration on captures by peripheral traps.

In the analysis of capture data, captures by a pair or set of traps were treated as total captures. Thus two captures at a set could be one mouse caught twice or two mice. Captures of male, female, immature, and mature mice were kept separate. Immature mice included juveniles and subadults. Mature mice were the adult animals and the breeding component of the populations on the area (Bendell, 1959).

In 1954, tunnel traps were used on Sheep Island. Mice learned to escape from these traps, with the result that empty and set-off traps were recorded frequently. Almost all set-offs were attributable to escaped mice so set-offs were included in the calculation of total capture by a set of traps. After 1954, Sherman live traps were used and escapement was negligible.

In 1955, on Cow Island, a long-tailed weasel (*Mustela frenata*) appeared to cause disturbance of traps from the last week of May until the first week of August. When there was much trap disturbance by the weasel, the data for that night were discarded. The effect of the weasel on captures of mice is discussed later.

METHOD OF DESCRIBING COVER

Two broad kinds of cover type were recognized on the islands; types identified by the dominant cover in the overstory, and types identified by the dominant cover on the forest floor. Each kind of cover was described by visual measurement of representative samples of the type. A sample description was an estimate of the amount of ground covered by tree (up to 15 feet high), understory (3-15 feet), and shrub (1-3 feet) layers of vegetation in an area of about 25-foot radius from the observer. The coverage by each layer was rated from 1 to 5, with 1 representing 0-20 per cent coverage, 2 representing 30-40 per cent, and so on up to 5 or 80-100 per cent. Within each layer an estimate was made of the amount of coniferous and hardwood cover.

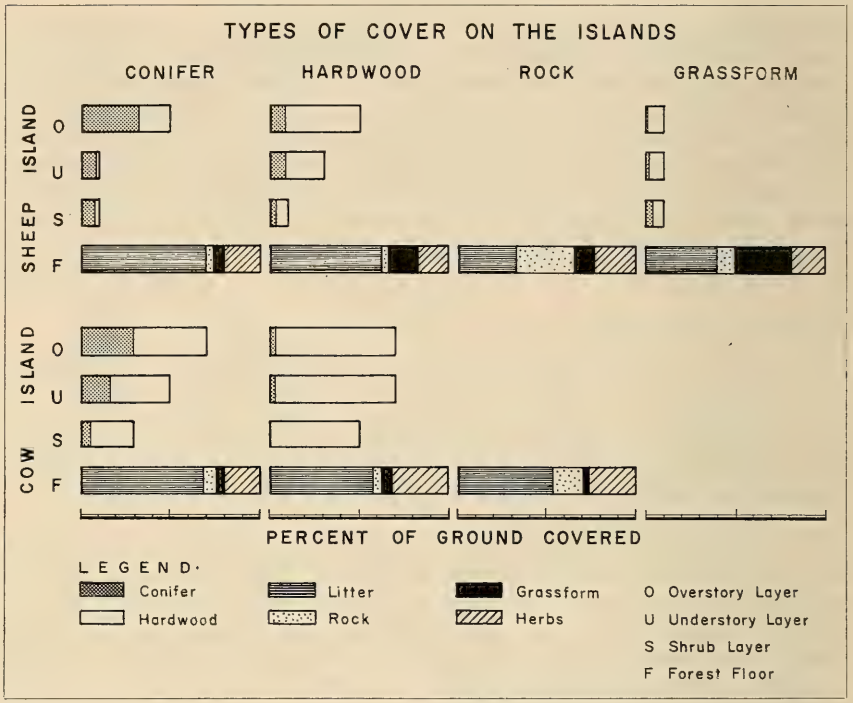

FIGURE 1. Types of cover on the islands. The number of samples in each type are from left to right: Sheep Island, 8, 11, 9, 2; Cow Island, 5, 11, 7.

The cover of the forest floor was described in essentially the same way as in the overlayers. Elements of the forest floor were litter, broken rock, and plants. Plants were recognized as grassform or herbs.

To obtain a general picture of a kind of cover, all descriptions of a type were averaged by layers. This gave average amount of cover and average proportion of elements of cover in each layer.

THE COVER ON THE ISLANDS

The kinds of cover recognized on the two islands are presented graphically in Figure 1 and illustrated in Figures 2 to 7. Both islands had a conifer forest, really a mixture of conifers and hardwoods, and a hardwood forest where hardwood species were dominant. The hardwood forest on both islands offered more understory and shrub cover than the conifer type. The ground layer of both types appeared the same.

A rock type also occurred on both islands and consisted mostly of expanses of broken rock. The rocks ranged in width from about a foot to three feet. Rock cover included exposed portions of bedrock that were cracked and fissured. The breaks in the rock provided many small, interconnecting openings and tunnels in the forest floor. Rock type occurred under conifer, hardwood, and grassform type overlayers.

FIGURES 2-7. Types of cover. 2. Conifer type, Cow Island. 3. Conifer type, Sheep Island. (The food box is approximately 1½ feet square.) 4. Hardwood type, Cow Island. 5. Hardwood type, Sheep Island. 6. Rock type, Sheep Island. (The reference rod is divided into units of one foot.) 7. Grassform type in foreground, Conifer type in background, Sheep Island. (All figures except number 6 were taken in May. Figure 6 is from October. The pictures were taken by Mr. S. M. Teeple.)

On Sheep Island, as shown in Figures 1, and 2 to 5, conifer and hardwood types were less dense than on Cow Island. Moreover, the hardwood cover on Cow Island had less conifer than that on Sheep Island. Then Sheep Island had a cover type, grassform, that was recognized on it alone. Grassform cover had sparse vegetation in the overlayers, with grassform vegetation the dominant cover of the forest floor.

RELATIONSHIP OF TRAPS TO COVER

After types of cover were identified, the extent of each type on the islands was mapped. The mapping of cover was facilitated by the trapping grids.

Both islands were roughly similar in topography and in the distribution of cover upon them. Both were more or less dome shaped. Sheep Island, the smaller of the two, had the steepest sides. On each island, hardwood type occurred mainly on the central upland, whereas conifer cover more or less fringed the islands between the shore line and the hardwoods. Rock cover occurred mostly on the sides of both islands. The grassform cover on Sheep Island was on the south slope between areas of conifer and hardwood.

To measure the relationship between capture of mice and cover, each set of traps was considered to catch mice in the types of cover within half the distance to adjacent sets. From the cover maps, each set of traps was classified by the types of cover that it sampled. The types of cover sampled by a set of traps were regarded as the habitat of mice captured in the set.

On Sheep Island the sets of traps sampled the habitats: Conifer (C), conifer being the only cover sampled by the sets; Conifer-Hardwood (CH), where both conifer and hardwood cover occurred in the areas sampled by the sets; Conifer-Hardwood-Rock (CHR), Hardwood-Grassform (HG), and Hardwood-Grassform-Rock (HGR). On Cow Island the habitats sampled were CH, CHR, H, and HR. In Tables 1 and 2 the first two columns list the habitats on each island and the number of sets in each kind of habitat.

RESULTS

Tables 1 and 2 give the results of grouping captures of mice by habitat and years on the two islands.

TABLE 1. COW ISLAND 1955, 1956. HABITATS, TOTAL CAPTURE OF MICE, SEX RATIO, AND AGE RATIO OF CAPTURES.

Habitat*	Number of Sets	Total Capture		Ratio of Male to Female		Ratio of Immature to Mature	
		1955	1956	1955	1956	1955	1956
CH	8	38	13	22/16	3/8	21/16	2/11
H	13	51	12	20/31	8/4	41/10	4/7
CHR	15	92	81	36/56	29/45	40/52	16/65
HR	17	73	35	25/42	11/19	66/7	6/29

* C — Conifer; H — Hardwood; R — Rock

TABLE 2. SHEEP ISLAND 1954, 1955, 1956. HABITATS, TOTAL CAPTURE OF MICE, SEX RATIO, AND AGE RATIO OF CAPTURES.

Habitat*	Number of Sets	Total Capture			Ratio of Male to Female			Ratio of Immature to Mature		
		1954	1955	1956	1954	1955	1956	1954	1955	1956
HGR	8	161	46	104	58/28	17/19	47/51	1/84	12/24	16/88
C	12	197	47	158	60/30	15/25	64/80	7/80	9/32	26/132
CH	13	201	50	130	56/31	17/32	89/48	0/82	17/33	18/112
CHR	12	192	78	164	86/53	35/40	79/79	2/136	16/64	48/126
HG	19	296	41	194	92/55	29/9	98/87	0/144	13/26	41/153

* C — Conifer; G — Grassform; H — Hardwood; R — Rock

TABLE 3. COW ISLAND 1955, 1956. HABITAT SELECTION OF MICE BY TOTAL CAPTURE, SEX, AND AGE OF CAPTURES.

Habitat*	Total Capture		Ratio of Male to Female		Ratio of Immature to Mature	
	1955	1956	1955	1956	1955	1956
CH	0	0	+♂	0	+M	0
H	0	0	0	0	0	0
CHR	0	+	0	0	+M	0
HR	0	0	0	0	0	0

* C — Conifer; H — Hardwood; R — Rock
For explanation of symbols see text, page 250

TABLE 4. SHEEP ISLAND 1954, 1955, 1956. HABITAT SELECTION OF MICE BY TOTAL CAPTURE, SEX, AND AGE OF CAPTURES.

Habitat*	Total Capture			Ratio of Male to Female			Ratio of Immature to Mature		
	1954	1955	1956	1954	1955	1956	1954	1955	1956
HGR	0	+	0	0	0	0	0	0	0
C	0	0	0	0	0	0	0	0	0
CH	0	0	0	0	0	+♂	0	0	0
CHR	0	+	0	0	0	0	0	0	+I
HG	0	−	0	0	+♂	0	0	0	0

* C — Conifer; G — Grassform; H — Hardwood; R — Rock
For explanation of symbols see text, page 250

In the analysis of data, chi-square tests, particularly the 2×2 table, were used to determine statistically significant differences between habitats in captures of mice. The .05 level of probability was used to decide on the significance of a deviation.

Tables 3 and 4 present the results of comparing by habitat and year the frequency with which all mice, and mice of different sex, and age were caught on each island.

In Tables 3 and 4, a positive sign means that significantly more mice were caught in that habitat than in habitats in the same column with a zero or a negative sign. A negative sign means that significantly less mice were caught in that habitat than in habitats in the same column without the same sign. Habitats in a column with the same sign did not differ significantly in captures of mice. Hence, positive, negative and zero signs in the same column indicate habitats in which mice were most frequently (positive sign), frequently (zero sign), and least frequently (negative sign) caught. Habitats in which mice were most frequently caught are considered to be selected by mice. Habitats where mice were least frequently caught are considered to be avoided. These comments also apply to the frequency with which male and female, immature and mature mice were captured in the habitats of the islands.

CONCLUSIONS

HABITATS SELECTED BY MICE

Mice selected and avoided habitats on the two islands. As shown in Table 4, mice on Sheep Island in 1955 were captured most frequently in HGR and CHR habitats, and least frequently in HG habitat. Since HG habitat was apparently avoided by mice and CH habitat did not yield as many captures as CHR it appears that rock cover was selected. Moreover, since all habitats with hardwood type, except hardwood with grassform, were used frequently by mice, it appears that grassform cover was avoided by mice.

On Cow Island, in 1956, more mice were caught in CHR habitat than in other habitats on the island (Table 3). Rock cover was again in the habitat that yielded the most mice. A long-tailed weasel disturbed trapping on Cow Island in June, July, and August of 1955. However, mice were most often captured in CHR habitat in May, before as well as when the weasel was present. I conclude that the weasel did not affect the relative frequency of capture of mice in the habitats of the island.

In summary, from the results considered thus far, the following conclusions can be stated. Mice on the two islands appeared to: (1) select rock cover in CHR and HGR habitats, (2) avoid grassform cover in HG habitat, and (3) neither select nor avoid C and CH habitats on Sheep Island or H, HR and CH habitats on Cow Island.

EFFECT OF AGE ON HABITAT SELECTION

In 1955 on Sheep Island, and 1956 on Cow Island, mice selected habitat. This was concluded from total captures of mice in different habitats. In 1955 on Cow Island selection of habitat was not apparent from total captures of mice (Table 3). However, from the same table, more mature mice were

caught in some habitats than in others. These data show that age of mice affects habitat selection.

In 1956 on Cow Island and in 1955 on Sheep Island the populations had consisted mostly of mature mice. On Cow Island in 1955, however, the age composition of the population was four immature to one mature animal. Note in Table 3 that, in 1955, immature mice were caught most frequently in H and HR habitats. Mature mice occurred most frequently in CH and CHR habitats. Similarly, the selection of CHR habitat on Sheep Island in 1955 and on Cow Island in 1956 was by mature mice. These results suggest that mature mice selected different habitats (CHR, CH) than those (H and HR) selected by immature mice.

Immature mice occurred least frequently in habitats where mature mice were caught, and mature mice selected the same habitat with or without immatures in the population. This suggests that either mature mice caused the young to occur in H and HR habitats or immature animals did not select the same habitats as mature mice. Either condition would put mice in H and HR habitats and so prevent the detection of habitat selection if the ages of mice were not considered.

In conclusion, age of mice affects habitat selection. In a population of predominantly immature animals on Cow Island, mature mice apparently selected habitats that were different from those of immature mice. Mature mice were captured most frequently in CH and CHR habitats, immature animals most frequently in H and HR habitats.

EFFECT OF DENSITY ON HABITAT SELECTION

From intensive trapping of Sheep Island in 1953 and 1954, the area did not support a natural population of mice. A relatively dense population of mice (19.4 per acre) was introduced to the area in 1954. This introduction failed. A second introduction was made in July 1955. Simultaneously, food was added to the island and maintained in excess of food consumed. In response to the abundant food, mice increased from a sparse population (6.0 per acre) in 1955 to a dense population (34.2 per acre) in 1956. Cow Island supported a natural but sparse population of mice (1.1 to 4.0 per acre) over the study.

Consider now density of population and selection of habitat. In 1954 on Sheep Island, population was dense and of mature mice. From Table 4, mice did not select habitat. Again in 1956 on the same island, mice in dense population did not select habitat as measured by the total capture of mice (Table 4). However, immature mice appeared to select CHR habitat. The numbers of mature and immature mice in this population were approximately equal. The selection of CHR habitat by immature mice is an apparent contradiction to the case presented earlier where mature mice selected CHR while immatures occurred in other habitats. An explanation is that data on immature mice in CHR habitats on Sheep Island in 1956 do not represent typical habitat selection. Since trapping began in May, very young mice were often captured. Then mature mice apparently select CHR for nesting. Hence, young mice were captured in habitat selected by their parents. This is not habitat selec-

tion by the immature mice and their greater occurrence in CHR habitat is disregarded.

The effect of density on habitat selection by mice can now be evaluated. Mature mice in sparse population on Sheep and Cow Islands selected habitat. Mature and immature mice in sparse population on Cow Island selected habitat. However, mature, and mature and immature mice in dense population on Sheep Island did not select habitat. This comparison leads to the conclusion that density of population affected habitat selection of both mature and immature mice. In dense population mice occurred equally in all habitats of the Island.

An obvious explanation of the effect of density on habitat selection is that in dense population mice filled the preferred habitats and caused others to occur in the less preferred habitats. The end result was an almost uniform distribution of mice and an apparent lack of habitat selection. This explanation is supported by studies of spatial relationships among white-footed mice (Bendell, 1959; Burt, 1940; Orr, 1959; Stickel, 1960).

EFFECT OF FOOD SUPPLY ON HABITAT SELECTION

The food provided in 1955 and 1956 to mice on Sheep Island was wheat. This was fed to mice from hoppers (Figures 3, 5, 7) that were distributed evenly over the island. One hopper was placed in the center of each quadrat formed by four trap sites. The food was kept in excess of that consumed. Food was not supplied to Cow Island.

In 1955 on Sheep Island, food was supplied in abundance and distributed evenly over the island. In this time on the island mice selected and avoided habitats. In 1955 and 1956 on Cow Island mice selected habitat. The sparse population on Cow Island and the strong response of population on Sheep Island to the addition of food indicated that food was in short supply on Cow Island. Thus mice selected habitats when food was in short supply and selected habitats when food was in excess and evenly distributed. I conclude that the selection or avoidance of habitats by mice was not related to the supply and distribution of food alone.

The effect of food supply on habitat selection by mice in dense population can next be evaluated. In 1954 on Sheep Island food was in short supply. The evidence for this is: (1) there was not a natural population of mice on the Island, (2) the introduced population of 1954 failed, and (3) the introduced population of 1955, supplied with food, flourished. Hence in 1954 on Sheep Island, mice in dense population did not show habitat selection when food was in short supply. In comparison, mice in dense population on the same island in 1956 did not show habitat selection when food was abundant. I conclude that the effect of density on habitat selection by the white-footed mouse was independent of the supply of food.

EFFECT OF SEX ON HABITAT SELECTION

From Tables 3 and 4, more male than female mice were caught in HG habitat on Sheep Island and CH habitat on both islands. Male *P. leucopus* have a larger range than female (Bendell, 1959; Townsend, 1935). Also, mice seemed to select rock cover for nesting. Hence a simple explanation of

observed differences in the sex of mice in habitats is that they resulted from the greater movements of males, and the restriction of females with young to nests and the cover used for nesting.

DISCUSSION

A general theory of habitat selection is that a species in low density fills the most acceptable habitats, and, as density of population increases, animals are forced into less acceptable habitats. The results of this study support this theory in that mice in sparse population showed habitat selection, whereas mice in dense population did not. It will be clear from this study, however, that habitat selection by the white-footed mouse is not a simple thing but depends upon the density of population as well as on the age and sex of animals in the population.

As another general comment, the response of mice to habitat must depend in large part upon the kinds of habitat that are available to them. Mice selected and avoided some habitats on the islands. However, mice in sparse population occurred with equal frequency in C and CH habitats on Sheep Island and H, HR and CH habitats on Cow Island. This suggests that mice did not distinguish between these habitats on the study areas. Hence habitat selection depends upon the habitats available to mice and the properties of their population.

With respect to the habitats studied here, mice were captured in all habitats on the two islands. However, habitats with broken rock in the forest floor appeared to be selected, and a habitat with grassform cover appeared to be avoided. Other authors have noted that *P. leucopus* was taken in habitats where there was rock (Kellogg, 1937; Rainey, 1955) and that it occurred infrequently in grassland (Hays, 1958; Pruitt, 1959).

Habitat selection was not related to food alone. Surprisingly, the addition of food to an area appeared to have little effect on habitat selection. This, and the selection of broken rock by mice suggests that habitat selection was primarily for protective cover rather than a supply of food.

There is evidence from this study that the selection of a habitat depends upon an important part of the habitat rather than the whole. CH habitat was not selected by mice and HG habitat was avoided. However, when rock cover occurred in either, mice selected them. Hence rock cover was the part that made habitats of different parts acceptable to mice.

It seems likely that selection of rock cover was for the escape terrain and protected nest sites afforded by broken rock. Direct evidence for this is that released mice often plunged into a space between rocks, a nest of a mouse was found in rock type, and mature and very young mice were associated with this cover. However, mice were observed to enter holes in the forest floor and run under logs so that broken rock cannot be considered the only cover used for escape and nesting.

That mice avoided grassform cover is offered as negative evidence for the importance of protective cover in habitat selection. Grassform cover appeared to afford the fewest opportunities for mice to nest as well as the least cover by

overlayers of the forest floor. Hence, mice have avoided grassform type for the lack of protective cover for movement and nesting.

In many tests of captures in habitats I was not able to demonstrate statistically significant differences among habitats in captures of mice. This could mean either that mice did not distinguish between these habitats or there were too few data to show differences in captures among habitats by the chi-square test.

ACKNOWLEDGMENTS

Mr. R. Lisk and Mr. R. Hurley assisted in gathering the trapping data used in this report. Mr. S. Teeple shared the task of describing vegetation. Financial assistance was provided by the National Research Council, and the Research Council of Ontario. Queen's University supplied basic facilities and power boats at Queen's Biological Station, Lake Opinicon. Mr. R. Y. Edwards and Dr. I. McT. Cowan read an early manuscript and offered constructive criticisms.

SUMMARY

1. Mice were trapped in different kinds of habitat and from populations of different properties on two islands in Lake Opinicon in eastern Ontario. Food was in short supply or in excess and distributed evenly over one of the islands. Data were analyzed to find and explain the local distribution or habitat selection of mice. Habitat selection was explained in terms of plant and rock cover, the properties of population, and food supply.
2. A habitat sampled by traps was composed of from one to four types of cover. Types of cover on the islands were: hardwood, conifer, grassform, and broken rock. Habitats were classified as Conifer, Hardwood, Conifer-Hardwood, Hardwood-Rock, Conifer-Hardwood-Rock, Hardwood-Grassform and Hardwood-Grassform-Rock.
3. Mice appeared to: (1) select rock cover and avoid grassform cover, (2) neither select nor avoid the habitats: Conifer, Conifer-Hardwood, Hardwood-Rock, and Hardwood.
4. Age of mice affects habitat selection. In a population of predominantly young animals, mature and immature mice apparently selected different habitats than those in which immature mice occurred.
5. Density of population affected the selection of habitat by mature and immature white-footed mice. In a dense population, mice appeared to fill preferred habitats and cause others to occupy less preferred habitats.
6. Habitat selection did not depend only upon a supply and distribution of food. The effect of density on habitat selection was independent of the supply of food.
7. It seems most likely that habitat selection was for protective cover for movement and nests.
8. Habitat selection in the white-footed mouse depends upon the kinds of habitat available to mice and the properties of their population. Habitat selection appeared to be for a part of a habitat rather than the whole.

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Letters to the Editor

Malaxis paludosa

Two naturalists have responded to the appeal for information in the paper on *Malaxis paludosa* (Can. Field Nat. 75: 74-77. 1961). Dr. A. E. Allin, Fort William, Ontario, wrote that there are two places named Silver Islet in Sibley Park and that this confusion in names may lead future field botanists astray. Garton and Campbell's collection No. 1297 was taken near the summer resort named 'Silver Islet' (not on topographic maps) on the mainland of the Sibley Peninsula and NOT from Silver Islet (shown on maps), which is merely a big offshore rock with no suitable habitat for our orchid. Dr. T. L. Tanton, Ottawa, noted that H. C. Cowles' letter with his 1909 collection reads:—Lake Surprise (NOT Superior) near Silver Islet—. W. K. W. BALDWIN

National Museum of Canada
Ottawa, Ontario

Request for Information on Migration of Buffleheads

A study of the Bufflehead is under way, and information on the migration of that species is needed. Data required include first arrival dates, peak date of migration and peak numbers, and departure dates. Only birds actually believed to be migrants should be listed, but, where pertinent, other data on wintering or summering numbers should be included. If only infrequent visits are made to areas frequented by Bufflehead, the statement "present by (date)" is preferable to "arrival (date)", and "last seen (date)" to "departure (date)". Information is solicited particularly for the spring migration of 1962, but it is hoped that interested observers will report any data they may have obtained in the past; requests for fall migration data will be made later. It is planned to color-mark some Buffleheads in Maryland, New York, and Oregon during the winter of 1961-62, and observers should take particular note of any Buffleheads bearing bright patches of red, yellow, or orange. Please send information on the Bufflehead to the undersigned.

A. J. ERSKINE

Canadian Wildlife Service
P.O. Box 180
Sackville, New Brunswick

REVIEWS

The Murres

By LESLIE M. TUCK. Ottawa, Department of Northern Affairs and National Resources, 1960. 260 p. $2.50.

Leslie Tuck's eagerly awaited account of the Common and Thick-billed Murres is announced as Number 1 of a series of monographs from the Canadian Wildlife Service. As such it sets a high standard for the series. The book will be of value to biologists in several disciplines; for the murres are among the most thoroughly marine of birds and play an integral part in the food chain in the northern seas. The two species of murre are so closely related, and breed together in so many colonies, that the author has been able to avoid much duplication by treating them together, although distinctions are faithfully presented.

Mr. Tuck's own studies cover most of the Canadian murre colonies and he is thus eminently qualified to write this monograph. His extensive personal knowledge of every phase of the murres' natural history has allowed a realistic interpretation of data from other parts of the world. The book is divided into 21 chapters grouped in 5 parts: Evolution and Adaptation; Distribution and Populations; Breeding Biology; Factors Affecting Populations; and Economics.

Nonmarine biologists will be well advised to read Dunbar's cited paper on arctic and subarctic marine environments; for marine usage of these terms is necessarily very different from the more familiar terrestrial usage. In other respects the text is thoroughly comprehensible without supplementary reading.

The narrative is strictly factual. It may be as well, therefore, to remind readers unfamiliar with the terrain of any of these colonies that study of the nesting birds can be both strenuous and hazardous. Frost-shattered arctic sedimentary cliffs are miserable places for study of any sort; and casual complications range from vile weather to inquisitive polar bears. This monograph is not the place for such dramatic sidelights; but the reader should remember that it was only through subjection to varied hazards and discomforts that the quantitative data so vital to the story could be secured by the author and his collaborators.

Much information is presented in the form of maps in which murre distribution is shown in relation to the phenomena under discussion. This is an excellent system; but a more accurate base map might have been used in a few instances. The inaccuracy is a minor matter in this monograph, but might be more serious in later works dealing with species that range further into the arctic islands. A minor point worth noting is that murre wrecks can be brought about without an on-shore gale. That of December 1952 was accompanied by only moderate easterly breezes. The birds seem to have been brought overland by a wind shift after dark, and, once lost, to have drifted downwind. The printing and illustrations are attractive and surely deserve a better cover. Plastic-coated paper becomes ragged-edged after the first handling.

D. B. O. SAVILE

Status Terminology and the Social Structure of North American Indians

By MUNRO S. EDMONSON. Seattle, University of Washington Press, 1958. 84 p. $3.00.

This book will probably be of little interest to the general reader. It will, however, be of no little value to anthropologists, ethnologists and others engaged in the study of North American aborigines.

The author is Associate Professor of Anthropology at Tulane University. For his study he has selected nine American Indian societies in different parts of the continent: the Eskimo, Chipewyan, Shoshone, Kwakiutl, Yokuts, Zuni, Sioux, Algonkin and Choctaw. The book is an analysis of the social levels

prevailing in these tribes, together with concise definition of each level. The terms are grouped under the heads of ascribed, achieved, and associational status, and there is a comparison of each society with the other eight. It appears that the author has given his fellow anthropologists an excellent method of comparing cultures, one which, as he says, demand no skills or training beyond those normally expected of the average field-working anthropologist.

An appendix listing all the different terms for the statuses is probably the most useful part of the book. One could wish, however, that under varying kinships the author had refrained from abbreviating in such a manner as to come near making gibberish of the whole thing. This is more an annoyance than a defect, but users of the book may find it irritating. It is probable, though, that other virtues in the work will more than make up for the annoyance.

FRANCES FRASER
High River, Alberta

Mrs. Fraser is the author of "The Bear Who Stole the Chinook" and other stories.

The Wilderness Cabin

By CALVIN RUTSTRUM. New York, Macmillan, 1961. 169 p., illus. $4.95.

In these days of automation it is refreshing to be reminded of the joys not only of living in wilderness cabins but of building them. Mr. Rutstrum, as in his previous book *The New Way of the Wilderness* published three years ago, has adapted modern time- and labor-saving methods to the construction of both traditional and modern cabins of all sizes. He covers, in clearly defined but not exhaustive detail, all the tricks of construction in stone, log, frame, and plywood. He defines the difficulties likely to be encountered by the inexperienced do-it-yourself builder and suggests effective remedies.

While recommending the esthetic and athletic advantages of hauling water and hauling and splitting wood, the author also gives useful suggestions on heating with propane and other labor-saving fuels and on air conditioning. He favors log and hand-hewn stone as traditional construction material, but feels that a chain saw is well worth its cost in traditional log construction because of the time it will save and the superiority of log-to-log fit it will ensure.

Mr. Rutstrum's 12 chapters, well illustrated with drawings and photographs, range from "Insight into sites" through "The auxiliary cabin" and "The chain saw and other tools" to "Some points on living in a cabin". His practical hints on maintaining a night-long wood fire with comfort and safety are a real contribution to cabin living.

Anyone planning to build a "wilderness cabin" either in the wilderness, in a near-urban area or a city backyard, will find a great deal of useful information in this attractive, easily read and well-made book.

VICTOR E. F. SOLMAN

Sex Ratios and Age Ratios in North American Ducks

By FRANCK C. BELLROSE, THOMAS G. SCOTT, ARTHUR S. HAWKINS, and JESSOP B. LOW. Urbana, State of Illinois, Natural History Survey Division, 1961. 84 p. $1.00 (Ill. nat. Hist. Surv. Bull. 27:391-474)

This monograph contains the result of over 20 years of research on the sex ratios and age ratios in populations of North American ducks. Difficulties involved in obtaining and interpreting data on sex and age ratios are thoroughly explained. The significance of these ratios in indicating population productivity is treated at some length.

The monograph will be of value to everyone with an interest in wildlife management and should also be a useful source for students of population dynamics.

Printing costs were financed by a loan from the National Science Foundation, and as a consequence there can be no free distribution of this publication.

DAVID A. MUNRO

Speak to the Earth

By WILLIAM A. BREYFOGLE. New York, Macmillan, 1961. 174 p. $3.75.

When an author, with Job, advises that a man should "speak to the earth and it shall teach thee," the thinking man must listen. The words that William Breyfogle speaks in this book of essays well deserve to be heard.

We are told in a brief memoir by Le Roy H. Dreher that Rhodes Scholar William A. Breyfogle (1906-1958) read widely, not only in his academic field of Greek classics, but in history, folklore and especially the literature of nature. The cause of his death is ironical in the extreme. One of nature's most benign creatures, a bee, reduced the author's years of study, reading and observation to a scant fifty-two.

The book, then, is to be read as the work of a reflective observer of nature. The reflections are properly clothed in essay form, because this is the medium that magnifies manner more than matter. At first the reader may be disturbed that momentum and strength accrue at a slow pace. On reading the first brief note, he will agree that "the world *is* one," but on continuing with "and therefore it can afford to wait patiently for our recognition of its unity," he will, in this year of nuclear fission complacently calendered 1961, scarcely be able to contain his impatience with a world that may not last long enough for its inhabitants to achieve that essential unity. The reader will recognize careless twists in writing, which the author was more easily able to allow when he wrote short stories. The reader may label as trite many lines that are so fundamental that only the simplest formulation of words could make acceptable, and he may wish that the dictionary, which served the author or editor so efficiently in the matter of spelling, had been close at hand when Breyfogle termed carbohydrates "hydrocarbons."

The same reader, however, as he continues, will see much of Breyfoyle the poet, the philosopher, the tremendous lover of nature's tremendous manifestations, the man with a rarely distilled message—and a potent warning.

As essays, the most successful parts of the book are, I believe, "On Living in a Village," a homespun rug shaped from the pattern of life; the thrilling "Traveler's Diary," which is based on notes written by the author's great-grandfather as he went from Ohio to California; "Auspices for Today," in which Aristophanes, serving as a catalyst for many cogent thoughts, produced through Breyfogle a beautiful, excellent essay.

The physical appearance of the book is attractive. It is wrapped with a simple, effective jacket. The covers are pasted with end papers of strong though cluttered drawing. The scattered illustrations are, for the most part, wistfully impressive, but hardly bear the repetition some of them get in this small book.

At the moment I am not sure how often one who owns this book will want to reread it. But his once-over will not be done lightly, and some lines the reader is bound to remember: "Human history is always a part of natural history, and one subject may often be made to illuminate the other." "It is not a baser nature but far wider opportunity that leads men to do wrong. Other animals behave virtuously because they lack the power to behave wickedly." "Perhaps, in the summing up, the truest kind of understanding is the sense of informed wonder." "The basic law of nature is balance. No matter what happens, nature will keep that balance. Nature does not give anything. It lends. It will continue to lend as long as the loan is returned. When the loans are not repaid, the borrower, Man, and not the lender, Nature, is eliminated." But I hope the reader, before he lays down the book, will think a while on its subject, thumb back to the first page and read again: "Try as you may to avoid it, you—or your children or grandchildren—must come back at last to your birthright, and find that you have been too long away."

ROBERT A. HAMILTON

The Heart of Thoreau's Journals

Edited by ODELL SHEPARD. New York, Dover Publications, 1961. 228 p. $1.60.

Henry David Thoreau, naturalist, writer, philosopher, is best known for his *Walden*, an account based on his two years' experience when he lived in a hut built by himself on the shores of Walden Pond, near Concord, Mass. Most scholars, including H. S. Canby in the *Encyclopedia Britannica*, agree that for an introduction to Thoreau a reader is best to begin with his most famous work. However, Thoreau is also remarkable for the journals he kept from 1837 until 1861, shortly before his death. In these journals he recorded his observations and thoughts of the moment. From them came the material, much reworked, that appeared in his published work. In fact, he expressed some doubt that the reworking really improved the original, as he says, "The crystal never sparkles more brightly than in a cavern," in his entry of Jan. 28, 1852.

The editor, by his choice of selections, has attempted not only to make the reader aware of Thoreau as a naturalist but also to focus attention on other facets of Thoreau's talents. Yet naturalists will find in these selections wonderful descriptions of nature. On Jan. 21, Thoreau wrote, "Every leaf and twig was this morning covered with a sparkling ice armor; even the grasses in exposed fields were hung with innumerable diamond pendants, which jingled merrily when brushed by the foot of the traveller. It was literally the wreck of jewels and the crash of gems. It was as though some superincumbent stratum of the earth had been removed in the night, exposing to light a bed of untarnished crystals. The scene changed at every step, or as the head was inclined to the right or left. There were the opal and sapphire and emerald and jasper and beryl and topaz and ruby.

"Such is beauty ever—neither here nor there, now nor then, neither in Rome nor Athens, but wherever there is a soul to admire. If I seek her elsewhere because I do not find her at home, my search will prove a fruitless one."

This is a beautiful reprint that belies its binding, as it is printed on fine paper in clear type and excellently bound. Indeed, it is a worthy successor to the original 1927 edition.

I. L. CONNERS

Watchers at the Pond

By FRANKLIN RUSSELL. Toronto, McClelland & Stewart, 1961. 265 p. $5.00.

Few recent books on natural history more vividly recall the nature stories of the late Sir Charles G. D. Roberts than does this recent novel on the animal and plant life of a large North American pond. Here portrayed is the seasonal cycle of life and death of myriad organisms that make up this complex aquatic-terrestrial environment.

The reader will be intrigued by the wealth of little-known information on the interrelationships of myriad microorganisms, of insects, spiders, crustaceans, flatworms and other small invertebrates, and of birds, mammals, and larger animal life. He may be just a bit disturbed by the continuous carnage in such innocent surroundings and perhaps exhausted by the author's forceful style and rapid-fire portrayal of life and death struggles. The very breadth and diversity of his subject has resulted in some inaccuracies such as in the depicting of the mandibulate dragonflies sucking their victims dry and dropping their bodies in the water. Some predator-prey illustrations, like that of a mantis catching and eating a hummingbird, are highly improbable and are evidently chosen more for their sensational and dramatic impact than for presenting the balanced pond ecosystem as it does exist. Nevertheless, the author is to be commended for his scope and for his skill in dramatizing a subject that every field naturalist should learn more about.

E. L. BOUSFIELD

A Yankee in Canada

By HENRY D. THOREAU. Montreal, Harvest House, 1961. 126 p. Paper, $1.65; cloth, $3.50.

Any publication by or about Henry David Thoreau is an event of importance. Harvest House is to be congratulated and warmly thanked for bringing before us, almost a century after it was first published, this absorbing account by the wisest of nature writers.

This is called a travel book. Nature is present from the very first page. Descriptions—of countryside, waterfalls, the St. Lawrence—are shot out with the force the scenes must have expelled onto the author's fertile mind. But this is more than a travel book. Man is a part of that nature, and the commentary of a man of Thoreau's stature will have a value as long as imperfect men exist.

A work of Thoreau demands, of course, no mere review, certainly nothing less than an essay, and a long one too. This periodical, at least in this section, affords no such scope.

Writers more capable than I have commented on *A Yankee in Canada,* the "Canada" being only a small section of what is today the Province of Quebec. They have noted, perhaps, that to only a man of great inner reserves could the monotonous scenery of "La Prairie" be exciting; that Thoreau perceived the "artificial look" of Lombardy poplars and the almost total absence of trees set out for shade or ornament; that the writer was indebted to Kalm for many descriptions or names of plants, and that he had a unique appreciation for geographic names in French Canada. Other writers may have smiled at—or otherwise reacted to—the lines about rust that, if "not on the tinned roofs and spires, . . . was on the inhabitants and their institutions"; but they would still have had to admit that it took a New Englander to say that "there is nothing of the kind in New England to be compared with" the waterfall of La Puce. Thoreau was impartial. He could write that the people of Montmorency County "had not advanced since the settlement of the country"; he could also say, a few lines previously, that in 1846 in Canada East the franchise was held by "a greater proportion than enjoy a similar privilege in the United States."

But in this present edition Thoreau is speaking to a people some three generations later. What might be his thoughts today? Would he wonder if, after almost a hundred years, the province had made any advance toward the Confederation that had been envisaged in 1867? Would he still seem to marvel at how far the New Englander's common sense is removed from the uncommon variety he beheld? Would he, perhaps, quip that for some individuals it has been no long trek from raquetteur to racketeer? Would he who considered forests "far grander and more sacred" than churches be appalled to see, on Mount Royal, God's sacred nature uglified by a monstrous shrine? Or would he still be critical of men and women who live under poverty, chastity and obedience, when he, a former recluse, would be the first to say that there is no single road through life? I wonder, even, if he would hear an earnest comment of one who acknowledges his greatness:

A peer in recounting impression, Thoreau seems to be seldom detached from academic discipline. I constantly feel that his caustic is only diluted by a *self*-conscious idealistic expression. On his journey to "Canada" he got to know no one. He seldom mentions his traveling companion and not once refers to him by name. When, in his beautiful essay on friendship, in "A Week on the Concord," Thoreau says that "men do not, after all, *love* their Friends greatly," he speaks for himself. If his humanitarianism were motivated by Christianity it might become complete, catholic and Catholic. The Christian's love is an intimate, personal, compelling power. It is what peace is made of.

In his well-written introduction to this edition, Mr. Maynard Gertler dips into a thrilling, virile epoch in history. From

it the reader may gain much he had not known or realized. Although the text type is easy to read, the total material book leaves much to be desired. But nothing physical can mar, or enhance, a message from Mr. Thoreau.

ROBERT A. HAMILTON

100 Shrubs of Ontario

By JAMES H. SOPER and MARGARET L. HEIMBURGER. Toronto, Ontario Department of Commerce and Development, 1961. 1 vol. (unpaged).

This is the third stage in a work designed to cover the estimated 150 shrubs in the province; 25 and 55 species have been treated in earlier instalments. Members of the willow, rose and grape families are still to be treated. Considering its still unfinished nature, users of the book will make allowances for its lack of completeness, the absence of keys and page numbers, and the numerous inconsistences in typography and setup it contains. The publication is not offered for sale; a limited number of copies are available free from the Department.

The descriptions are practical, and particularly good for checking the characters of the shrubs encountered in the field. The full-page drawings (by Leslie Garay and Ronald With) are accurate and clearly depicted. The maps of distribution, showing only those locations where the species are reliably known to occur, are the result both of painstaking checking of all available specimens and records and of extensive exploration on the part of the authors. As such, the maps are an outstanding and welcome contribution to phytogeography. While it is doubtful whether further collecting would greatly alter the patterns they expose, it is presumably the authors' intention to incorporate in their final printing any authentic additions brought to their attention. A certain obligation would therefore seem to fall on those who are fortunate enough to obtain a copy.

WILLIAM G. DORE

Birds of Regina

By MARGARET BELCHER. Illustration by Fred W. Lahrman. Regina, Saskatchewan Natural History Society, 1961. 76 p. $1.00 (Spec. Publ. Sask. nat. Hist. Soc. 3)

The geographic scope is a circle 30 miles in diameter with center at the Saskatchewan Legislative Buildings in Regina. Twelve introductory pages are devoted to a lucid description of the area with emphasis on the primary habitat types and the birds characteristic of each of them. There is a short history of bird study of the area and the main sources of information are given. Treatment and terms used are clearly defined.

The annotated list (pages 16-74 inclusive) contains 268 species ascertained to have occurred in the area. Three additional species are listed hypothetically. The annotations are definite and extremely well documented, there being none of that exasperating vagueness so often encountered in annotated lists. Terms used to evaluate the general status of each species conform with those recommended by the Federation of New York State Bird Clubs. The detailed data are precise and well chosen. There are many useful notes on local habitat preferences, a subject too often neglected by many writers. Spring arrival data are well covered but autumn departure data are scanty, presumably because the latter are not so abundantly available.

Interesting bird sketches by talented Fred Lahrman, as well as a number of photographs, are scattered through the text. There are two useful maps and a list of the literature cited.

From the over-all planning to proof reading this publication shows evidence that consistently meticulous work has gone into its preparation. Everyone either actively or potentially interested in the birds of the area should have a copy. Visitors to Regina will find that it is more than an authoritative list of the birds they can expect to find. It will also be a great help on where to find them.

W. EARL GODFREY

OTHER NEW TITLES

Drawings of British Plants, Part Fifteen: Compositae (1). By STELLA ROSS-CRAIG. London, Bell, 1960. 28 plates. 9s. 6d.

Drawings of British Plants, Part Sixteen: Compositae (2). By STELLA ROSS-CRAIG. London, Bell, 1961. 33 plates. 9s. 6d.

Radio Telemetry of Electrocardiograms and Body Temperatures from Surgically Implanted Transmitters. By WARREN O. ESSLER. Iowa City, State University of Iowa, 1961. 35 p. (St. Univ. Ia Stud. nat. Hist. Vol. 20, No. 4)

Techniques for Determining Age of Raccoons. By GLEN C. SANDERSON. Urbana, State of Illinois, Natural History Survey Division, 1961. 16 p. Free (Biol. Notes, Urbana. No. 45)

The Medusae of the Chukchi and Beaufort Seas of the Arctic Ocean, Including the Description of a New Species of *Eucodonium* (Hydrozoa: Anthomedusae). By CADET HAND and LAI BING KAN. Montreal, Arctic Institute of North America, 1961. 23 p. Price: to members of the Institute, 50 cents; to nonmembers, $1.00 (Tech. Pap. arctic Inst. N. Amer. 6)

NOTES

Swainson's Thrush on Meighen Island, Franklin District

ON 16 JULY 1960, while I was at Isachsen with the Polar Continental Shelf Project, a bird was brought back for identification from the Decca Navigation Station on the west coast of Meighen Island, 80°00′N 100°00′W. On receiving the specimen I was surprised to find that it was a Swainson's Thrush. On making up the skin, I found the body to be devoid of fat (and somewhat dessicated, through having been dead for perhaps two weeks) but not emaciated. The condition suggested that it had died from exposure rather than actual starvation. No trace could be found of the gonads, which had perhaps diminished as a result of malnutrition; the sex therefore remains in doubt.

When I visited the Decca Station on 28 July, Mr. Arthur Payton told me that the bird had appeared perhaps four weeks previously and had been seen for two days at the garbage dump before he found it dead. Lacking a precise arrival date, I have not attempted to trace the weather sequence that might have accounted for this exceptional case of overshooting. It is probable that the bird was attracted to the station by the antenna masts, the only objects suggestive of trees in an almost featureless landscape. Meighen Island lies some 900 miles from the closest forest in the neighborhood of the Mackenzie delta; and the last few hundred miles of the presumptive track crosses the bleakest part of the entire arctic archipelago. The Decca Station, close to the sea ice, is in an exceptionally sterile region that is almost entirely devoid of plant and animal life (Savile, Can. J. Bot. 39:909-942.1961).

The bird's plumage proved to be severely bleached for the time of year, evidently through exposure to continuous daylight and lack of shade; and the rectrices and remiges were unusually worn, perhaps from repeated contact with bare ground. However, Mr. W. Earl Godfrey has been able to determine that it belongs to the Alaska-Yukon race, *Hylocichla ustulata incana* Godfrey. It is thus possible that its passage across the barrens was not greatly above the 900-mile minimum.

D. B. O. SAVILE
Plant Research Institute
Ottawa, Ontario
15 May 1961

The Long-tailed Vole in the Northern Yukon Territory

THERE ARE no published records of the long-tailed vole, *Microtus longicaudus vellerosus*, from the northern Yukon territory. The northern distribution of the species in Canada is usually drawn through the central Yukon. Two specimens in the National Museum collections from Rampart House on the Porcupine River at the Alaska boundary, (Numbers 23736 and 26330), therefore merit recording. The first specimen is a male, measuring 155-55-20 mm, collected by J. E. H. Martin on May 20, 1951. The second is a female, measuring 140-44-20 mm, collected by C. C. Loan on May 26, 1951. Both collectors were on a Department of Agriculture insect survey and incidentally secured mammals for the Museum.

A. F. W. BANFIELD

National Museum of Canada
Ottawa, Ontario
24 April 1961

Clay-colored Sparrow in Southern Quebec

ON MAY 23, 1960, at about 8 a.m., I was walking across a pasture near the village of Philipsburg, Missisquoi County, Quebec, when I heard an unfamiliar song from a clump of trees. Because of the persistence of this singing, I was eventually able to view the bird clearly and to identify it as a Clay-colored Sparrow (*Spizella pallida*).

Knowing that the bird was far east of its normal range, I wanted other witnesses. I therefore returned later the same morning with a party of six, including my wife and Mr. and Mrs. Edwin Hawkins of Philipsburg. The weather was dull, with occasional splashes of rain, but the bird was still singing. As we approached it fell silent and moved away. We were unable to locate it, but when we sat quietly near the spot where I had first seen it, is soon returned and resumed singing. We were able to observe it at leisure and Mr. Hawkins photographed it with a 35-millimeter camera through a 30-power telescope.

Its favorite perch for singing was near the top of small cedar, about eight feet from the ground. Sometimes it moved onto a higher perch in a white birch. Both trees were on the margin of the clump. Its song was rudimentary, two buzzing notes, *bzz - bzz*, repeated quite regularly at ten-second intervals. None of us had heard this species before, so I checked the song on R. T. Peterson's recording. The note was the same, but the recorded bird uttered more at a time. A. A. Saunders, in *A Guide to Bird Songs*, states that the Clay-colored Sparrows that he had heard all gave two buzzes only.

I returned to the site on May 28 and June 5 and saw the bird singing in the same place. I next returned on June 11, but neither then nor on subsequent visits was I able to find it.

I later heard that on June 6, the day after I last saw my bird, Mr. Robert Carswell, of Ste. Anne de Bellevue, saw a Clay-colored Sparrow in a plantation of young evergreens in the Morgan Arboretum, Macdonald College. He was alone when he first saw it but came back later that day with Mrs. Donald Elliot and Mr. Kerry Rowe. He returned on June 8 with Miss Gwen Farnsworth and saw is again. It was not seen thereafter. Its conduct was similar to that of the Philipsburg bird, and its song had two notes only.

So far as I have been able to learn, the previous easternmost records in Canada were of one seen by Mr. L. McI. Terrill (1952, Can. Field Nat. 66(5): 145) near Merrickville, Lanark County, Ontario, on July 1, 1951; and one at Ottawa observed by Mills (1957, Can. Field Nat. 71(3): 155) on May 20, 1954. I had the advantage of comparing notes with Mr. Terrill shortly after seeing my bird. My bird's behavior was closely similar to his, except that his sang with four buzzes.

It would appear either that the same individual moved from Philipsburg to the Morgan Arboretum, some fifty miles to the northwest, or that several birds having the same singing habits migrated off their normal course into southern Quebec.

GEORGE H. MONTGOMERY

4689 Westmount Avenue
Montreal 6, Quebec
20 April 1961

A Red Bat On Southampton Island, Northwest Territories

A RED BAT, *Lasiurus borealis*, was observed flying about in the aircraft hangar at Coral Harbour, Southampton Island, on August 15, 1954, by A. G. Loughrey then with the Canadian Wildlife Service. Mr. Loughrey managed to capture the specimen, which was a male, having the following measurements: total length 90 mm, wing spread 90 mm, forearm 42 mm. He prepared the specimen and donated it to the National Museum of Canada where it was catalogued as no. 27822. Unfortunately the local pet cat stole the skull.

This record constitutes a range extension of approximately 1100 miles northward from the vicinity of Winnipeg, Manitoba. It is interesting to note that there is also an exceptional record of the hoary bat, *Lasiurus cinereus*, from the same locality.

A. W. F. BANFIELD

National Museum of Canada
Ottawa, Ontario
24 April 1961

Summer Tanager at London, Ontario

ON MAY 21, 1960, I collected a female Summer Tanager, *Piranga rubra*, at London, Middlesex County, Ontario. The specimen, which is now in the collection of the University of Western Ontario, is noteworthy for two reasons. First, it is the first record of this species for Middlesex County and only the seventh specimen for Ontario, the remainder being in the collections of the National Museum of Canada and the Royal Ontario Museum. Secondly, the color of the rectrices is remarkable. The six left rectrices are Brownish-Olive to Yellowish-Olive (Ridgway). The color of the six right rectrices, however, is stikingly different: brown on the inner webs and rust-brown on the outer.

DAVID M. SCOTT

Department of Zoology
University of Western Ontario
London, Ontario
23 March 1961

Reprints Wanted

Dr. James R. Tamsitt would like to exchange reprints of articles on mammalogy. His address is: Departamento de Biología, Universidad de los Andes, Apartado Aereo 4976, Bogotá, Colombia.

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